SCIENTIFIC AMERICAN

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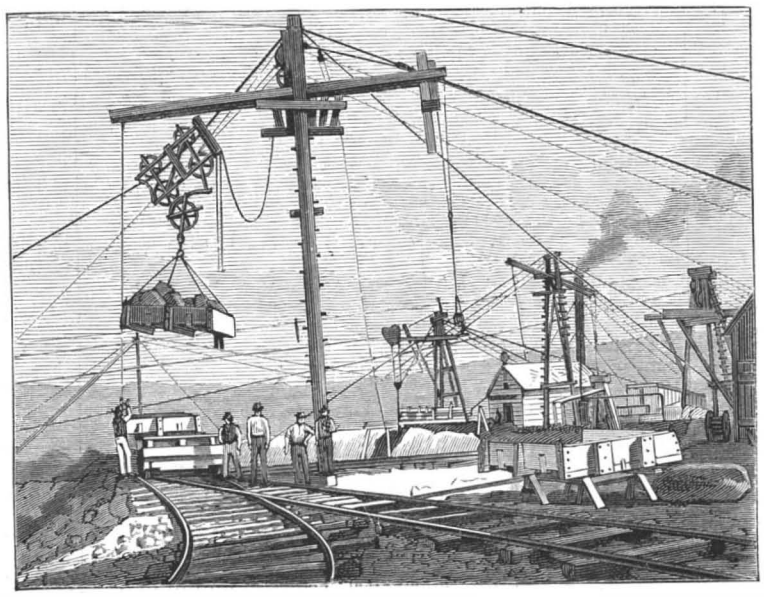
THE TILLY FOSTER MINE.

For nearly two years past a most interesting piece of engineering work has been progressing in the reopening of the Tilly Foster iron mine, near Brewster's Station, Putnam County, about fifty miles from New York City, on the line of the New York and Harlem Railroad. The mine is owned by the Lackawanna Iron and Coal Company, and its ores have long been considered very valuable, having been principally used at Scranton and Bethlehem, Pa., in the production of Bessemer pig. The expense of getting out the ore, however, has been great, owing to the irregular and nearly vertical overlying strata, and the production has steadily declined, the stratification necessitating the leaving of large quantities of ore in position in the pillars and roofs. An attempt was made to use concrete pillars, but these artificial supports were found to be too liable to crush and their use was abandoned. All other plans having failed, it was finally determined to adopt the bold scheme represented in our illustration, which is nothing less than the entire removal of the whole of the overhanging rock, thus making the mine an open cut.



ENGINES, AIR COMPRESSORS, AND HOISTING PLANT.

The work was commenced in June, 1887, and up to March of this year 230,000 cubic yards of material had been removed. The excavation is now about 450 feet long, 300 feet wide at the widest part on top, and 170 feet deep. Of the material thus far taken out, there have been some 15,000 cubic yards of rock in which ore was mixed. The total contemplated rock excavation amounts to 350,000 cubic yards, in order to secure an estimated quantity of 1,000,000 tons of ore. The contract price for the rock excavation was $1.15 per cubic yard, the taking out of the ore and separating it from the rock being paid for at a higher figure. One thousand tons of material are handled every ten hours, through the aid of a series of wire cables stretched across the pit.

REOPENING THE TILLY FOSTER MINE, NEAR BREWSTERS, N. Y.

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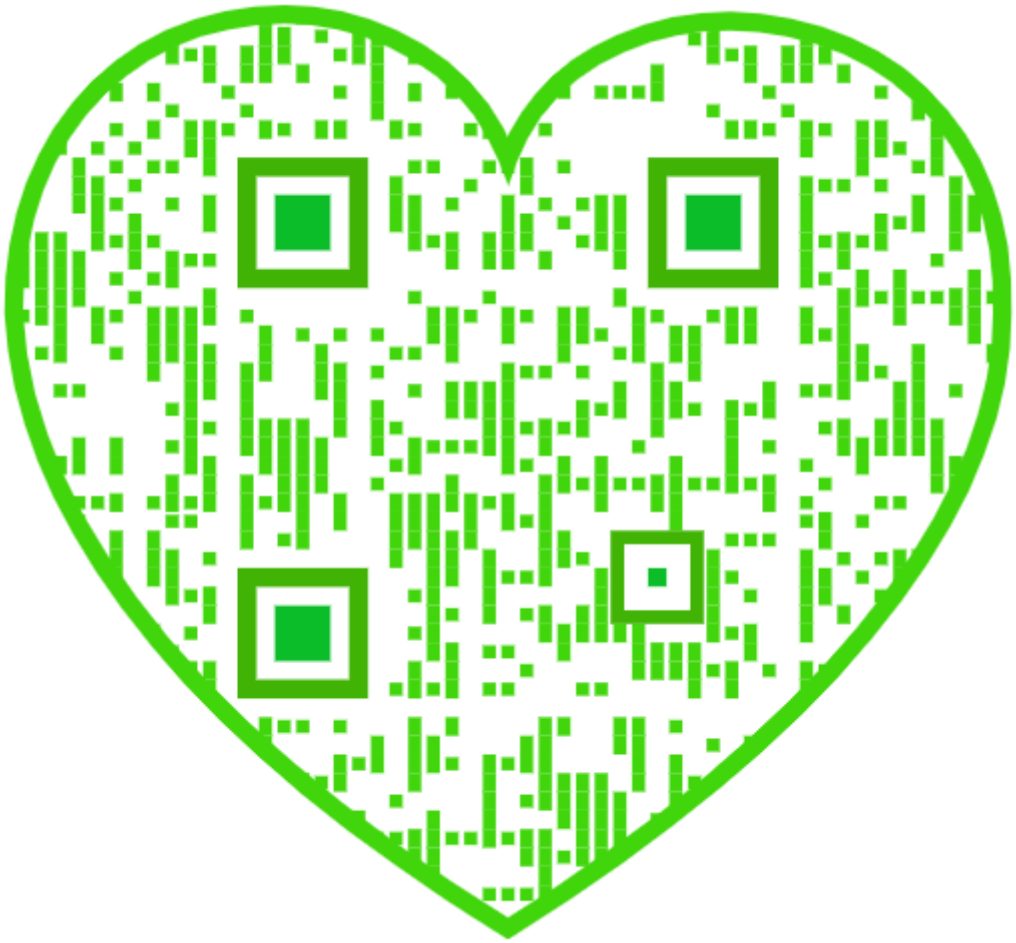

Two methods of working the cables are employed. In the first the main cable is stretched entirely across the pit, and is supported by derricks at each end. On this cable a trolley runs, its motion being controlled by an endless cable driven in either direction by a reversible engine. The hoisting is done by an independent rope driven by a drum of its own, which can be run independent of or in conjunction with the traversing drum. With this construction hoisting can be done from any part of the main cable, and delivery made at either end, the rock being delivered at one end of the cable, from which it is sent to the rock pile, while the ore is delivered at the other end into the cars for shipment. By the other system of working the cable is inclined, its lower end being secured in the pit, while the hoisting and traversing are both done by a single rope and drum. The point of the cable from which the hoisting is done can be regulated at will by changing the position of a stop block on the main cable. The trolley runs down the cable until it strikes the block, when the trolley stops and the load is lowered directly, the position of the stop block being controlled by an independent rope which winds around a drum of its own. The empty car bodies are lifted directly from the trucks and lowered into the pit, where they are loaded and hoisted back again. One load is equal to one and one-fifth yards of rock, measured as it lies in the bed.

It is said that this excavation is to be carried down to a total depth of some 600 feet, but it is estimated that there will be but slight increase in the cost of the work on account of the increased depth. Ten Rand drills are in use, and rackarock is employed as an explosive. The cost of explosives is said to have been about ten cents per cubic yard, and the cost of lifting and disposing of the rock about five cents per cubic yard. Mr. F. H. McDowell is the engineer under whose direction this work has been carried on.

The Paris Exhibition.

The Machinery Hall, which occupies nearly the whole width of the Champ de Mars, is the largest building covered by one roof in the world. Its central nave measures 375 ft. in width and 1,380 ft. in length, and is roofed in by one span. On either side are galleries 57 ft. 6 in. wide, and these have a ground and first floor.

The cost is given in an official return as $1,502,785, made up as follows:

Earth work and masonry	$118,485
Iron work	1,079,660
Wood work	38,750
Covering, lead and zinc	47,335
Flooring	15,715
Joiners' work	6,865
Glazing	36,445
Decoration	51,220
Painting	31,705
Miscellaneous	38,025
Engineers	38,580

Three-quarters of the space of the Machinery Hall is occupied by France, and the remaining quarter is divided between Great Britain, the United States, Belgium, and Switzerland.

Rolling Liquid Metal.

Among the interesting and successful of recent inventions is a rolling mill for producing sheet metal direct from the molten state, instead of rolling it from a billet or bar. A machine of this character has been at work for several months at the can factory in Maywood, near Chicago. It is used for making sheet solder, six or eight inches wide, and $\frac{15}{1000}$ of an inch thick, which it produces at the rate of 400 feet a minute.

The apparatus consists of hollow rolls with cold water running through them. The water is introduced through the axles, and the rolls are of sufficient size to at once change the jet of melted metal into solid form as fast as it is fed. The powerful compression exerted by rolls upon the molten metal in forcing it between the two surfaces, and at the same time changing it to a solid body, tends to give to the sheet an even and highly finished surface. The inventors of the machine believe that the principle could be successfully applied to the rolling of Bessemer steel, as well as to softer metals. Mr. O. W. Potter and other officers of the North Chicago Rolling Mill Company recently examined the machine, and expressed themselves as being favorably impressed with its work.

AT a recent meeting of the London Linnean Society, a paper was read by Mr. Lister on the Myxomycetes, or Mycetozoa, a group of organisms on the borderland between the animal and vegetable kingdoms and formerly classed with fungi. His remarks were illustrated by numerous colored drawings of representative species, and the author also exhibited under the microscope the swarm cells from the spores of *Amaurohœte* and the streaming plasmodium of *Badhamia*. Attention was especially directed to the mode of feeding of the swarm cells and observations made on those of *Stemonitis*, where large bacilli were seen to be caught by pseudopodia projected from the posterior end of the organism, and drawn into its substance and digested.

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A German Electrical Executioner.

There are signs of reforms in the method of execution in other countries besides America, says one of our foreign contemporaries, but it is doubtful whether the German government will adopt the excessively dramatic mode which has been recommended to it by a certain Leipzig inventor. His apparatus consists of a platform nine meters square, approached by five steps. In the center of the platform is a chair for the condemned man. Behind it stands a figure of Justice holding a pair of scales in her left hand. Under the platform is a series of electrical accumulators, from which wires pass through the legs of the chair into the seat and back, and terminate in platinum plates. The patient having been seated, the executioner reads the sentence, and then, taking a wand, breaks it and deposits the pieces in one of the scales. This descends, completes the necessary connections, and so ends the matter. In Germany, indeed, reform is just now being loudly clamored for, public opinion having been greatly stirred by a tragedy which occurred a few weeks ago, when, it may be remembered, the imperial executioner, in a fit of jealous rage, kicked one of his assistants to death. It is contended with some show of reason that the crime was, to some extent, attributable to the brutalizing effects of the prisoner's occupation.

Wages in the United States in 1800.

The condition of the American wages class nearly a century ago is full of instruction. In the large cities, unskilled workmen were hired by the day, bought their own food, and found their own lodgings. But in the country, on the farms, or wherever a hand was employed on some public work, they were fed and lodged by the employer, and given a few dollars a month. On the Pennsylvania canals the diggers ate the coarsest diet, were housed in the rudest sheds, and paid $6 a month from May to November, and $5 a month from November to May. Hod carriers and mortar mixers, diggers and choppers, who from 1793 to 1800 labored on the public buildings and cut the streets and avenues of Washington, received $70 a year, or, if they wished, $60 for all the work they could perform from March 1 to December 20. The hours of work were invariably from sunrise to sunset. Wages at Albany and New York were 3s., or, as money then went, 40 cents a day; at Lancaster, $8 to $10 a month; elsewhere in Pennsylvania workmen were content with $6 in summer and $5 in winter. At Baltimore men were glad to be hired at 18d. a day. None by the month asked more than $6. At Fredericksburg the price for labor was from $5 to $7. In Virginia white men employed by the year were given £16 currency; slaves, when hired, were clothed, and their masters paid £1 a month. A pound, Virginia money, was, in Federal money, $3.33. The average rate of wages all over the country was $65 a year, with food and perhaps lodging. Out of this small sum the workman had, with his wife's help, to maintain his family.

No Oxygen in the Sun.

The Paris correspondent of the *Daily News* states that M. Janssen, of the Academy of Sciences, claims to have made a discovery which upsets the entire theory based on the analysis of celestial bodies by means of the spectroscope. On May 12 the electric lamps of the Eiffel Tower were turned on the Meudon Observatory, which is 7,800 meters (4 miles 7 furlongs) away. He reckons that the mass of air lying in a given section of that length at the height of the tower is equal to the atmospheric mass above. M. Janssen argues from this that the number of molecules of air encountered by a beam of light sent from the Eiffel Tower to the observatory is about the same as that met by sunlight on its way to the earth when the sun is near the zenith. He then shows that if the analogy holds true, the belief that the sun contains oxygen is unfounded, and that if its spectrum contains the characteristic oxygen rays, this is due to the oxygen of our atmosphere. One of the fundamental theories of spectrum analysis is that the width of the characteristic bands of a gas is proportionate to the number of molecules that intercept the light. Now in the above experiment the most important rays of the oxygen group were precisely similar to those of the solar spectrum. The conclusion M. Janssen draws is that there is no oxygen in the sun.

THE arrangements for paying the price of admission to the Paris exhibition are somewhat peculiar. All tickets issued are of the value of one franc or 20 cents each. On week days, from 8 to 10 A. M., two separate tickets must be presented to obtain the right of entrance. From 10 A. M. until 6 P. M., a single ticket is sufficient. After 6 P. M., two tickets are necessary. On Sundays the same arrangement for morning visits is adopted, but from 10 A. M. a single ticket will serve. The regulation is fairer than was anticipated, as it is possible to spend twelve hours in the exhibition and enjoy the evening fetes for 20 cents. Few will object to paying an extra franc to have the advantage of seeing the objects when the galleries are less crowded.

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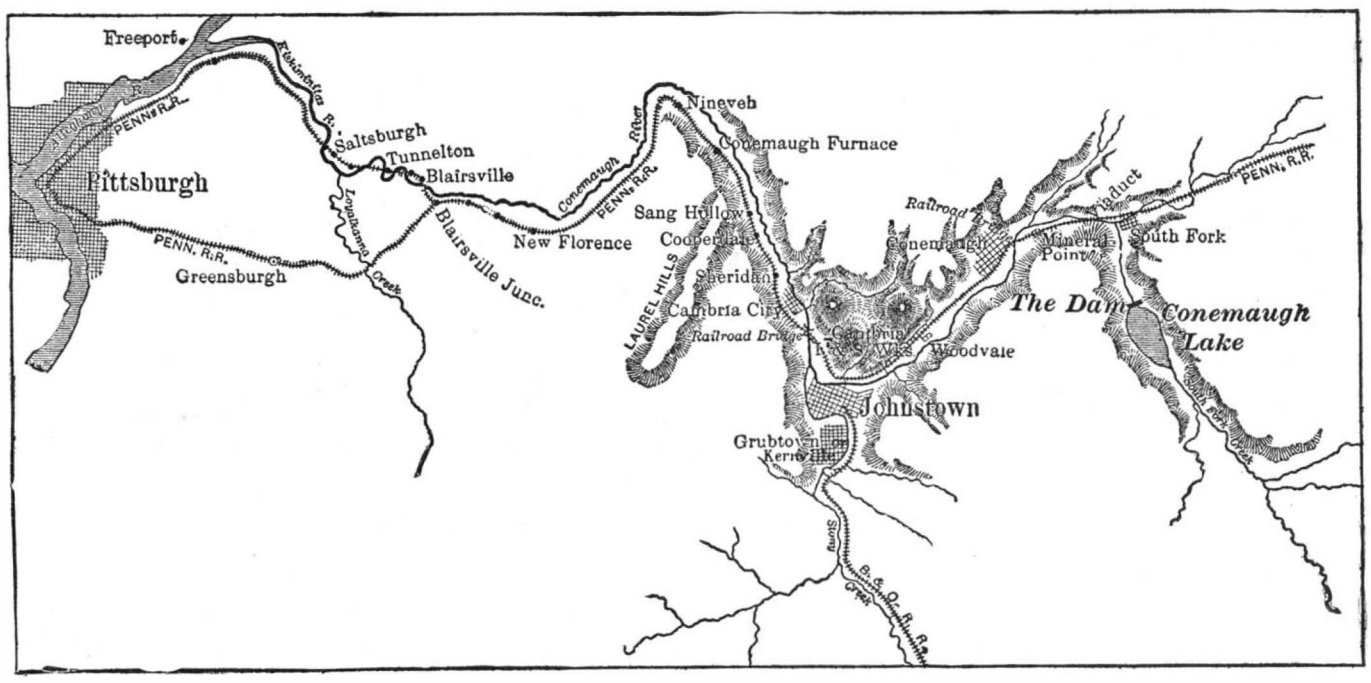
AN APPALLING DISASTER.

THE COLLAPSE OF THE SOUTH FORK DAM AND THE DESTRUCTION OF JOHNSTOWN, PA. — SEVERAL THOUSAND LIVES LOST.

The appalling disaster of the bursting of the dam holding back the waters of South Fork Lake in Pennsylvania, by which Johnstown and the villages and country near it on the main line of the Pennsylvania railroad were swept into ruin, will rank among the great catastrophes of the world. The English-speaking race has never before been afflicted by a catastrophe of equal moment. The flood, with the added horrors of conflagration, was due to the sudden escape of the waters of one of the largest artificial lakes in America.

To give a general idea of the nature of the country in which the disaster occurred, a map, not however drawn to scale, is herewith given. The South Fork Lake was an artificial body of water formed by a dam that for many years had held back the waters of the South Fork of the Conemaugh. It was built about thirty-five years ago by the State of Pennsylvania to impound water for use in feeding the western division of the Pennsylvania canal. The chief engineer of the State furnished the plans and specifications. In 1859 the Pennsylvania railroad came into pos ession of the dam and reservoir by their purchase of the canal. About five years ago the lake was leased to a fishing club, who stocked it with fish, built a club house, and supplied the other appurtenances necessary for their sport, and who were entitled the South Fork Lake Association. The dam was seventy feet high and extended across a narrow gap in the mountains. At its top it was several hundred feet long and about twenty feet wide, and a wagon road ran across it. A number of wasteways or tunnels went through its base, which were provided with gates. It is said that these had been permanently closed. At its center it was some feet lower than at the sides, so that the old lateral overflow or sluiceway was inoperative to prevent the disaster.



MAP OF THE JOHNSTOWN FLOODED REGION.

The South Fork is a little stream, at its entrance to the lake about ten feet wide, and only carried enough water to fill the lake in the course of a year. The water thus held formed an irregular lake about one and a half miles wide and running back several miles before dwindling down to the ten foot stream supplying it. Its maximum depth was about one hundred feet.

The lake and dam had never of late years been thought particularly secure. The heavy rains that prevailed over the State of Pennsylvania for many days had swollen the waters of the Conemaugh and its tributary streams, and Johnstown and the region adjoining it were to a certain extent flooded. On Friday, May 31, apprehensions began to be felt for the dam, and warnings were sent to Conemaugh, Johnstown and the other villages. But similar warnings had been sent out so often before that these ones were generally disregarded, and people continued their occupations in the partly flooded city of Johnstown and Kernville. At Conemaugh more heed was given to the danger and work was generally suspended in the factories at noontime, and the people took to the higher ground.

At the lake there was a party of some forty laborers engaged on some drainage works. The water rose so rapidly that the superintendents became alarmed and set them to work to provide a sluiceway to give a chance for the water to escape. From time to time messengers went down with warnings of danger to the country below. The laborers could not work fast enough to cope with the rise, and at about half-past two o'clock in the afternoon the water began to pour over the top of the dam, surmounting it by about a foot. All day long it had been rising at the rate of a foot an hour. The water rushing over the top now began to carry off the upper part of the earth dam, making a gully which rapidly deepened and soon cut away the whole central part of the dam nearly down to its rocky foundation. It was about this time that Mineral Point, South Forks, and the adjoining villages received their last warning. It was given by a boy on horseback, who came galloping down from the dam, reaching the settlements, a mile and a half away, in six minutes. Two minutes later the first wave struck them. The water was now flowing out of the lake, and at once a gap was formed which, before the lake was emptied, grew to a width of three hundred feet at the top and extended clear down to the bed rock. Through this gap the waters poured in a cataract, and by four o'clock the lake was empty, and thousands of people on the line of the South Fork and Conemaugh had perished.

The first course of the water was down the South Fork, and at its junction with the Conemaugh a portion of the water backed up and inundated the village of South Fork, while the main body went down the Conemaugh. At the junction of the South Fork and Conemaugh the water met the Portage viaduct, a State work which carried the old post road and parallel with which the Pennsylvania railroad runs for many miles. Upon these tracks near Conemaugh the day express train was standing in two sections. Track and viaduct were swept away, the trains with most of their passengers being engulfed. The ruins of the cars were found six days later near the stone bridge below Johnstown. The water continued to rush down the Conemaugh nearly at right angles to its previous course. The portion which had backed up through South Fork returned and swept the villages of South Fork and Mineral Point away, and joined the main body on its way toward Johnstown. It spread to right and left, sweeping away houses, trees, and everything in its course, and destroying and carrying off with it a part of all the villages on its track. At East Conemaugh it wrecked the railroad yard buildings and the round house, throwing the locomotives in every direction. Its worst work was now to be done, for the great destruction of life had not begun. It cut a second channel for the Conemaugh, and in five minutes had carried away nearly the whole of Woodvale, a settlement of about three thousand inhabitants. The valley was now filled with water bearing the great mass of wreckage with it. The right and main portion that followed the old bed of the river swept down through Johnstown, carrying away perhaps a quarter of the town. It had already destroyed one substantial iron bridge, but below Johnstown it met the stone railroad bridge and was checked, the debris piling up against the arches. The left portion now came surging down Stony Creek, already swollen into a torrent. The outlet of this creek was also choked, and the main flood backing up from the stone bridge met the Stony Creek current. The combined floods meeting formed a whirlpool that covered the flats on which the greater portion of the houses stood, and whirled round and round, destroying nearly all that was left of Johnstown and Kernville, and carrying away thousands of the inhabitants to drown and burn, before it worked its way beneath the ruins held back by the stone bridge. Masses of wreckage composed of houses and contents covering an area of several acres were accumulated here. Under and among them were thousands of human beings, many yet living. Fire now added its horrors to the scene, and soon the wreck was in flames. Down the Conemaugh toward Pittsburg numberless bodies were carried, while others less fortunate were burned in the ruins. Wreckage was seen three hundred miles down stream on the waters of the Ohio River.

At present the whole country is engaged in the relief of the suffering. The amount so far subscribed is nearly two millions of dollars. The number of lives lost is not far short of ten thousand, but will never be accurately known. The loss of property is probably nearly equal to ten millions of dollars.

Scenes of heroism are reported. The famous ride of Paul Revere found a second parallel in the action of a mounted messenger who rode down the valley shouting out a warning to the inhabitants. The waters overtook him and he perished. Mrs. H. M. Ogle, for many years an operator in the service of the Western Union Telegraph Co., with her daughter, were caught by the flood at Johnstown in the telegraph office. They continued telegraphing warnings to the villages below until they too were drowned in the building whence they had dispatched their messages.

The region has been placed under martial law. Militia troops are quartered there, and a great body of laborers, nearly ten thousand in number, have worked long and hard, clearing away the ruins and disposing of the known and unknown dead. Great fears are entertained of a pestilence, due to the bodies of human beings and animals that have not been disposed of, which may, if once started, spread far and wide. The water supply of Pittsburg, drawn from the Allegheny River, is menaced, and the citizens have been instructed to filter and boil the water before using it.

The same rains that broke down the dam caused havoc and ruin elsewhere. A very large area of Pennsylvania suffered from floods. Log booms were broken away, and hundreds of thousands of dollars' worth of timber were carried down into the Chesapeake Bay. Williamsport and the regions near it were great sufferers, farms being inundated and live stock and buildings being destroyed. But the great loss of life at Johnstown has drawn public attention away from what, in comparison only with it, can be called minor events.

Johnstown was famous as being the site of the Cambria Iron and Steel Works, one of the great industrial establishments of the world. Their loss is very heavy, but it is believed that very soon operations in some form will begin again. The works included the most perfect appliances for the manufacture of Bessemer steel products, and a very complete industrial settlement had grown up around them. The city was largely the outgrowth of the great works. It was the county seat of Cambria County, Pa., and with other smaller settlements constituted a borough containing about 20,000 inhabitants. It was 79 miles east of Pittsburg by railroad distance.

Transmission in Geese.

A correspondent of the *Revue Scientifique* vouches for the following story: For about twenty years he was in the habit of visiting two or three times each year a farm where was kept a flock of geese, numbering from thirty to thirty-five in the early part of the winter, and in the spring four or five, left for breeding purposes; these also generally being killed a few months later, after the new broods had attained their growth.

In the month of July, 1862, on a feast day, the farmer and his men being absent, the geese were forgotten, and were attacked by dogs, which killed the most of them. The next evening at twilight the farmer thought they must have been attacked a second time. He found them flying about in their pen, much frightened, but the dogs were nowhere to be seen. The next day this terror reappeared at the same hour as it did on the following day, and from that time on. The correspondent of the *Revue* had forgotten this fact, when, ten years later, he chanced to be on the farm one evening, and heard the cackling of the apparently frightened geese. When he asked for an explanation, he was told that this had been kept up from the time they had been attacked by the dogs, that there had been no repetition of the attack, and that the flock had been renewed in the meantime at least three times. If this story is well authenticated, we have a case of the transmission of terror to the third generation in a family of geese.

THE following is suggested by Professor Samuel Sheldon, of Harvard University, for an electric blowpipe. The pole of a powerful magnet strongly attracts or repels the electric arc, which may by this means be driven out sideways into a point very similar to the point of flame projected from an ordinary blowpipe. At the end of this point the heat is intense, being sufficient to melt large copper wire constantly and to fuse any of the metals. It would serve admirably for welding, and a slight alteration would fit any lamp to perform the double function of lighting and welding.

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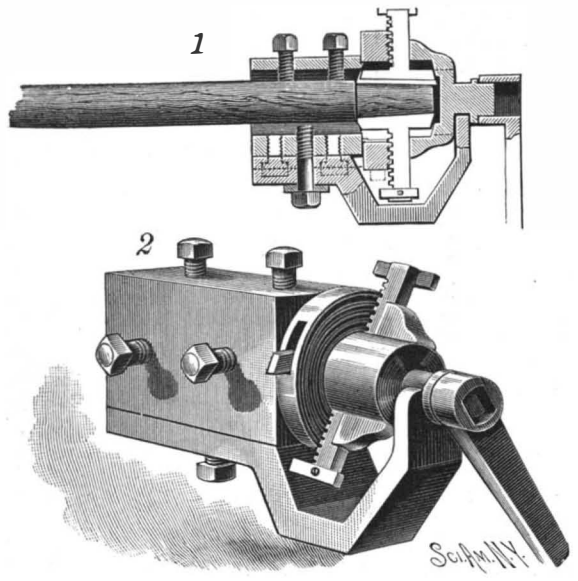
AN IMPROVED MACHINE FOR TURNING TENONS.

The accompanying illustration represents a machine especially adapted for use in connection with vehicle spokes, and with which a tenon may be turned of any desired depth, the cutters then being automatically released. The invention forms the subject of a patent issued to Mr. Wilson Rogers, of Barboursville, West Va. Fig. 1 represents a longitudinal vertical section of the machine, and Fig. 2 a view in perspective. In the

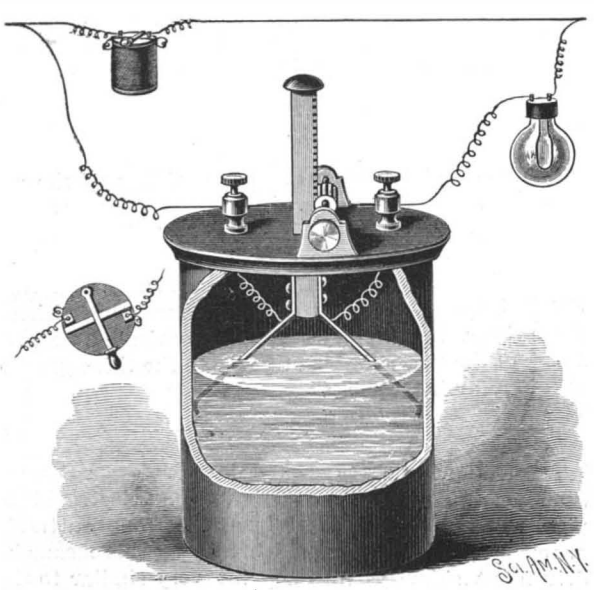


ROGERS' MACHINE FOR TURNING TENONS.

sides and top of a stationary casing are threaded apertures, each adapted to receive a set screw to engage the sides of the spoke and hold it in fixed position, while the base supporting the casing has a central slot through which three set screws are passed, the longer one retaining the casing in firm contact with the base, a longitudinal rib upon the bottom of the casing being adapted to enter a groove in the base. At the inner end of the casing the base is stepped downward to form a yoke portion, in which is held a rotary cylinder, abutting against the casing, and having longitudinal slots adapted for the reception of cutters located within the cylinder. The inner end of the fixed casing has a circular reduced section, upon which is snugly fitted a ring having a screw thread on its outer face, the ring having a recess in its periphery in which is pivoted a pawl adapted to enter a recess in the reduced portion of the casing. The cutters have a straight shank projected from the outer surface of their blades, and upon this shank are transverse teeth adapted to mesh with the thread upon the outer face of the ring fitting upon the reduced section of the fixed casing. The extremity of the trunnion of the rotary cylinder, projecting beyond the yoke bearing, is squared to receive the socket of a crank arm. To introduce the spoke, the central bottom set screw is loosened and the base plate slid to one side, when the cutters are raised and the rotary cylinder introduced into the casing. A trip block is then secured upon the shank of the cutters to regulate the depth of the tenon, and as the crank arm is revolved, the cutters are fed down by the contact of their shanks with the ring fitting upon the reduced portion of the fixed casing, the cylinder and the ring being locked together by the engagement of the threaded surface of the ring with the teeth of the cutter shanks.

AN IMPROVED ELECTRIC CURRENT REGULATOR.

A cheap instrument for regulating electric lights, so that they can be turned up or down, as with gas or



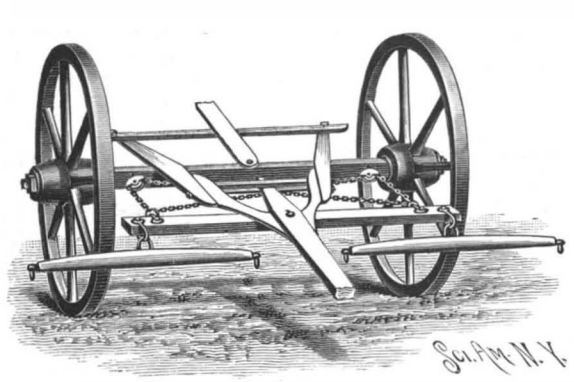
CROUCH'S RHEOSTAT.

lamps, and whereby the dynamo will thus be relieved by the short-circuiting of the current, has been patented by Mr. Frank J. Crouch, and is illustrated herewith. A vessel is employed containing a saline or other chemical solution, such vessel being of any desired shape or size, but preferably of the style shown, and in connection therewith are diverging conducting arms connected in circuit with the main line and insulated, a central arm being adapted to be lowered into the solution to any desired depth, the brilliancy of the light being decreased or increased as the central rod is raised or lowered. Binding posts are secured to the cover of the vessel and insulated therefrom, and a transverse shaft, with a central pinion and a thumbscrew at one end, is journaled to extend across the top of the cover, the pinion operating a rack bar on the vertically moving central rod. On opposite sides of this rod are secured the upper ends of a pair of downwardly diverging spring conducting rods, preferably made of copper, whose lower ends bear against the sides of the vessel. Coiled conducting wires connect the binding posts to the conducting arms, and enable the plunger rod to be moved up or down. The conducting wire of the electric light system is connected to the binding posts, completing the circuit through the spring conducting arms and the solution in which they are immersed. A shunt circuit connects the wires of the system, this circuit having a resistance coil made to balance the lamps used on the circuit, and the coil having a switch, shown in the small figure, to cut off communication between the coil and the shunt circuit. It is said that an instrument containing only three gallons of the liquid will readily regulate eighty lamps of thirty candle power each, and it is stated that such instruments have been used for more than a year past, with great satisfaction, in theaters and elsewhere.

For further particulars with reference to this invention, address the Crouch Patents Manufacturing Company, Eugene City, Oregon.

AN IMPROVED DRAUGHT EQUALIZER.

A equalizer to be applied to the doubletree and front axle of a wagon, mower, or other vehicle has been patented by Mr. John Bevens, of Marine Mills, Minn., and is represented in the accompanying illustration. The equalizer consists of two crossed chains, cords, or ropes, each attached by a clevis and ring or other connection to both ends of the doubletree, and each passing through one pulley attached to the vehicle. The chain



BEVENS' DRAUGHT EQUALIZER.

on one side passes from the end of the doubletree, around the pulley on the end of the front axle immediately behind it, and thence crosses to its connection with the opposite end of the doubletree, the opposite chain also crossing in a similar manner. The doubletree is slotted in the center, so that the draught will not come on the bolt, and the doubletree is preferably placed beneath the tongue to relieve the team somewhat of its weight. The chains so crossed in the center are designed to take the whole draught or strain of the load, each acting on both ends of the doubletree.

Planting Trees.

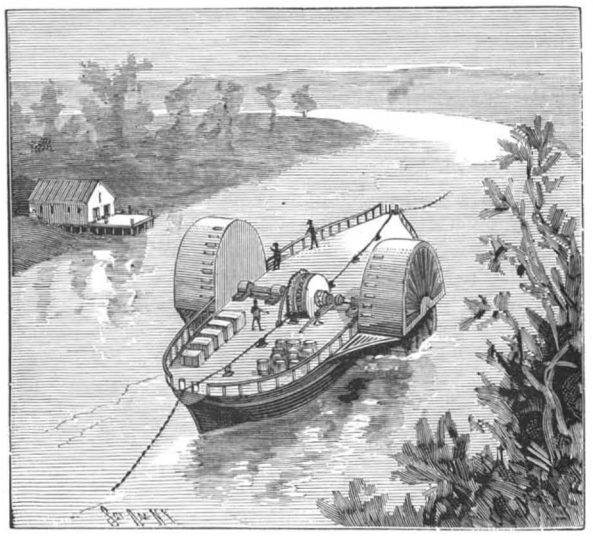
Digging big holes for trees should be unnecessary. Dr. Warder said that the hole for a tree should be as large as the orchard. This is the best of advice. It means that the ground should all be well prepared before a tree is put into it. Then one needs to dig only far enough to allow the roots to fall in easily. But the hole must be big enough for the roots. Do not twist or crowd them; and here is where the ordinary tree planter will shirk. Before you know it, he will stick in a tree with the ends of the roots all but peeping through the ground. "Don't be stingy with your holes," is advice which I have to give almost every day in planting time. Get the fine earth firmly in and about the roots. This usually requires the work of the fingers, but it can be done without fussing.

Athletes and Athletics.

Irving Ross, M.D. (*Jour. Am. Med. Assoc.*), holds that the popular opinion as to the danger to health and life connected with great muscular exertions is in the main fallacious. He has never found a case of hernia caused by over-exertion, though he has known many hundreds of athletes. He maintains that they are not more subject to aneurism and heart disease than other people; that instead of having their lives shortened they are, as a rule, a rather long-lived class, citing a number of noted examples in proof; that where disease or death does come early it can generally be shown to be due to free indulgence of gross appetites and indulgences; in short, that "all the manly sports should be encouraged and fostered with a view to promote qualities that intimately concern not only the happiness and usefulness of individual life, but also the good of society and the future of the human race."

AN AUTOMATIC CABLE PROPELLER FOR VESSELS.

A simple construction by which the force of the current of a river may be utilized to propel the vessel



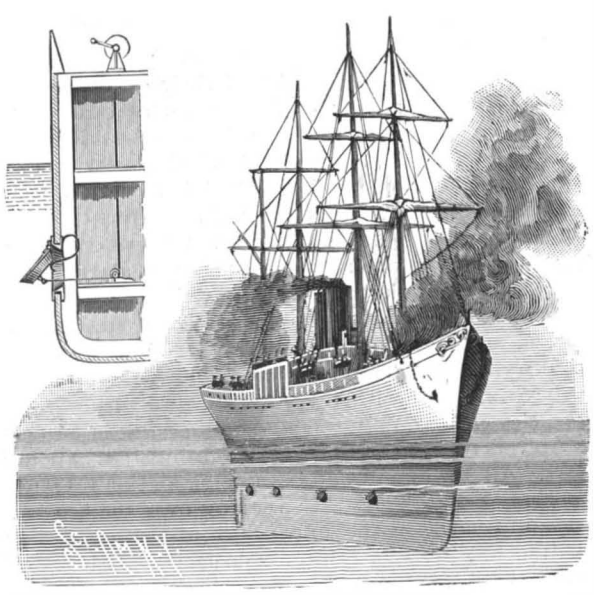
LOTZE'S CURRENT PROPELLER FOR VESSELS.

against the current is illustrated herewith, and forms the subject of a patent issued to Mr. Ernst Lotze, of Spokane Falls, Washington Territory. A chain is placed on the bottom of the river for the full length of the space intended to be thus navigated, the upper end of the chain being firmly anchored, while its lower end is buoyed, so that it may be conveniently raised and placed over the boat under a central wheel clutched to a main shaft, carrying side wheels on its outer ends.

This central wheel is adapted to engage and move up or climb the chain as the wheel is revolved, and may be fixed on the shaft, but is preferably clutched thereto by means of a sleeve and clutch blocks, so that it may be thrown out of engagement when desired, while on the shaft is a disk with ratchet teeth engaged by a pawl, forming a brake to prevent the vessel from floating down stream when the clutch block is thrown out by engagement with the shaft. Guide rolls from the chain are arranged on the bow and stern of the boat, while horizontal rolls on the boat direct the chain into proper contact with the central wheel, under which it passes. It is said that a model of this construction, 5 ft. long and 10 in. wide, easily carries a load of fifty pounds, and works well.

A DEVICE FOR EXTINGUISHING FIRES ON SHIPS.

The illustration herewith represents a means of flooding the interior of a ship, for extinguishing fire, which forms the subject of a patent issued to Mr. B. D. T. Travis, of Burlington, N. J. The invention provides for a valve, or series of valves, seated in the wall of the ship, below the water line, opposite the different compartments. These valves open outward, and are hinged on their upper side, as shown in the small view, a spring being made to press against the inner face of the valve to force it outward into open position when the valve is released. This is effected preferably by a small cable, fastened by one end to the inner face of the valve, while its other end is carried



TRAVIS' FIRE EXTINGUISHER FOR SHIPS.

up between the decks and made fast to a windlass. By unwinding the cable on the windlass, the spring causes the valve to swing outward, whereby the water can pass into the vessel, to flood one or more of the compartments, as desired.

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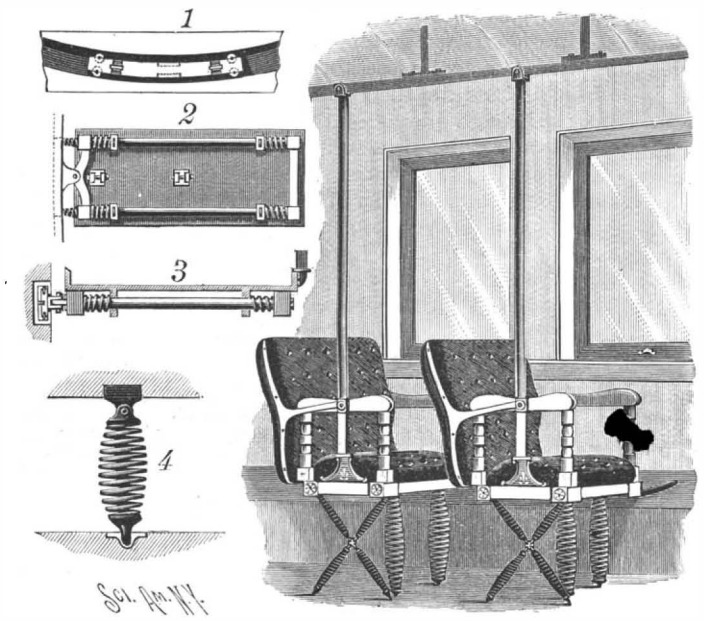
AN IMPROVED CAR SEAT.

The illustration herewith represents a novel construction of railroad passenger car seats, in which the seats are ordinarily held in fixed position, but are caused to swing in case of collision, thus retaining their occupants from being thrown out of their seats or from being jammed or crushed by contact with adjacent seats. Each of the seats is carried, at its end farthest from the side of the car, by a pendant rod pivoted to the car roof, while a curvilinearly grooved plate, shown in Fig. 1, is secured in the side of the car body, with a roller slide fitting therein, to support the car seat at its other



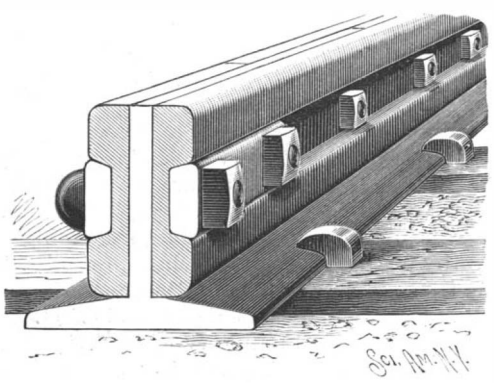
ENEQUIST'S CAR SEAT.

end. Figs. 2 and 3 represent an under side view and section of one of the seats, with its attached frame, composed of back and front longitudinal rods and cross bars, this frame being connected to the under side of the seat by lugs, so as to allow a slight movement of the seat in the direction of its length, springs being interposed between the lugs and the ends of the cross bars of the frame. The cross bar next the side of the car is connected with the roller slide moving in the grooved plate by being pivoted intermediately of its length to the slide, small springs being interposed to keep the seat square and prevent twisting. The seats are ordinarily held stationary, in part, by upright springs, as shown in the perspective view and in Fig. 4, and in part by a series of diagonally arranged springs permanently attached to the frame of the car seat and the floor of the car. The upright springs have an upward pressure, and are jerked out by a violent shock only, being fitted in the floor by sockets. The diagonal springs also serve to restrain the seats from swinging too violently while returning them to their normal position afterward. The construction is also designed to add to the comfort of railroad travel by mitigating the severity of the sudden jerks and shocks so frequently experienced on trains traveling at high speeds, while the car floor can be readily scrubbed and cleaned.

For further information relative to this invention address the patentee, Mr. Erik Enequist, in care of L. Feuchtwanger & Co., Long Island City, N. Y.

AN IMPROVED COMPOUND RAIL.

A railway rail made in three parts and designed to be durable and easily repaired has been patented by



CHAMBERLAIN'S COMPOUND RAIL.

Mr. Edward G. Chamberlain, and is illustrated herewith. It is preferably made of steel, and has a central strip with flanged base, side bars being clamped to the central strip by means of bolts and nuts. The side bars rest upon the base and extend to the top of the central strip, while they are of similar shape at the top and bottom, so that they may be reversed when one edge becomes worn or injured. To form a continuous rail and prevent "pounding" of the car wheels the parts may be made to overlap and break joints, the side bars breaking joints midway between the ends of the rails.

For further information relative to this invention address Mr. Edward G. Chamberlain, in care of the Consolidated Ice Machine Co., Chicago, Ill.

Anti-fouling Paint.

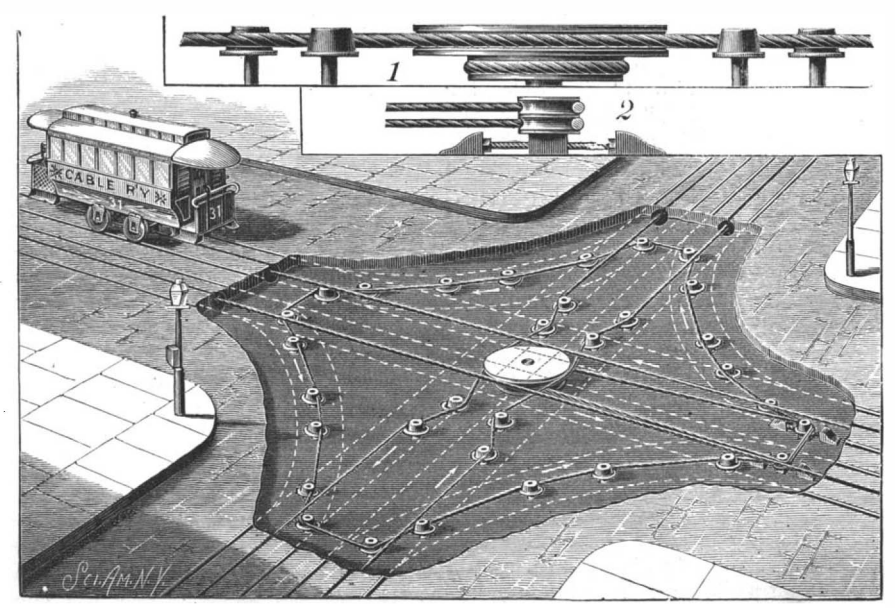
An important experiment with anti-fouling paint has been brought to a conclusion with the docking of the Indian troopship Crocodile at Portsmouth on her third and final passage from Bombay. It was the custom formerly to dock the Indian troopships at the end of each voyage to India and back, for the purpose of inspection and repainting. Subsequently, in consequence of improvements in the nature of the compositions used, they were enabled to perform two voyages out and home without docking. More recently, as the inventor of the paints, Colonel-Commandant Crease, C.B., Royal Marine Artillery, contended that the three passages to Bombay and back could be performed without the necessity of intermediate docking and repainting, the Crocodile was selected by the Admiralty for trial. Her bottom was coated early in September last with one coat of anti-corrosion and one coat of specially prepared anti-fouling paint, and she started on her first trip to India on the 18th of that month. She concluded her third voyage, without having been docked in the meantime, on the morning of April 25 last, each voyage having been made in good time, although during her last trip she suffered, in consequence of an accident in the Suez Canal, an unavoidable delay of a day and a half. By special order from the Admiralty, she was docked on April 26, with the result that, with the exception of a belt of grass, tapering from six feet wide below her central water line on the starboard side, and a little more on the port side, to nothing at all at the extremities, her entire bottom was perfectly clean, being free from weeds, barnacles, and other incrustation, and also quite protected in every part. This excellent result, obtained with a single coating of anti-fouling composition, has been pronounced by the dockyard authorities and the experts sent specially down to inspect the ship from the Admiralty to be the most satisfactory hitherto obtained. It was remarked that the fine grass on the Crocodile's bottom only grew where she had been scrubbed with brushes by the ship's company, and where, it is assumed, the skin had been denuded of paint.

Filling for Nail Holes.

The following method of filling up nail holes in wood is not only simple, but said to be effectual: Take fine sawdust and mix into a thick paste with glue, pound it into the hole, and when dry, it will make the wood as good as new. Frank Christin, Jr., in *Stoves and Hardware*, says he has followed this for thirty years, with unvarying success in repairing bellows, which is the most severe test known. Often by frequent attachment of new leather to old bellows frames, the wood becomes so perforated that there is no space to drive the nails, and even if there was the remaining holes would allow the air to escape. A treatment with glue and sawdust paste invariably does the work, while lead, putty, and other remedies always fail.

AN IMPROVED CABLE CAR TRANSFER SYSTEM.

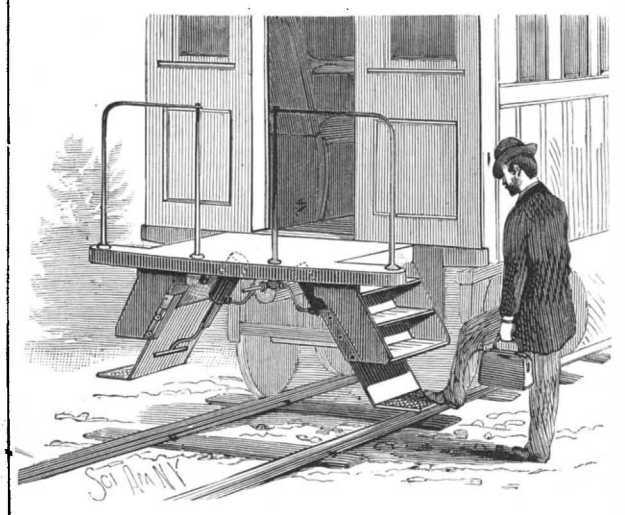
A means of transferring a car from one propelling cable to another, at the intersection of cable railways, and wherein the propelling cable is utilized to effect such transfer, is illustrated herewith, and forms the subject of a patent issued to Mr. Allen R. Parkeson, of Monongahela City, Pa. Each of the surface tracks has the usual underground propelling cable, but these cables cross in direct lines at their intersection, as shown by the arrows, and do not extend around the curves conforming to the turnouts. In the conduit at the center of the crossing or intersection of the tracks is journaled a large pulley, to which motion is communicated by two or more of the propelling cables, such cables being brought in sufficient contact therewith by means of guide rolls, as shown, or considerably greater frictional contact of the cable with the pulley may be obtained by crossing the cables at each side of the pulley. A smaller pulley is secured below the large driving pulley, as shown in Fig. 1, and an auxiliary cable from this smaller pulley is carried thence around tightening guide rolls journaled below the grip slots of two of the intersecting tracks, and around other guide rolls, to form a loop and an approximately four-sided figure, as shown by the arrows, with curved sides and ends projecting into the four lines of tracks forming the crossing. The tightening guide rolls are shown in Fig. 2, and are journaled upon a block which slides in suitable guideways, and has a screw by means of which it may be adjusted longitudinally in the line of the loop branch of the auxiliary or transferring cable. By adjusting the tightening rolls away from the main driving pulley, the loop and the entire auxiliary cable are tightened. The latter cable travels with less speed than the main cables, on account of the smaller size of the pulley from which it receives motion, thus carrying the cars with proportionately less speed around the curves than their rate of travel upon the straight tracks, while an increase of power is obtained to overcome the greater frictional resistance of the track.



PARKESON'S CABLE CAR TRANSFER SYSTEM.

AN IMPROVED EXTENSIBLE CAR STEP.

A car step mounted to slide in ways secured to the under side of the permanent car steps is shown herewith, and has been patented by Messrs. James F. and John F. Wood, of Wilmington, Del. To the casings which support the permanent steps are secured castings formed with ways, serving as guides for a diagonal leaf rigidly connected to a tread, anti-friction rolls being carried by the leaf within the ways. To the rear under face of the leaf is secured an arm carrying a piston working in a cylinder connected by means of a tube with the compressed air reservoir of the air brake system, there being a spring above the piston. The arrangement is such that when pressure is on, as when the cars are running, the auxiliary treads are held up, but when the pressure is thrown off, that the brakes



WOODS' EXTENSIBLE CAR STEP.

may be applied, as in approaching a station, the springs force the steps down to convenient position for use, the steps again returning to their raised position after the brakes are thrown off. The steps can be worked independent of the brakes, if so desired, by having a separate pipe from the main compressed air reservoir at the engine, by means of which the engineer can lower the steps whenever he chooses.

For further information relative to this invention address Messrs. James F. Wood & Co., Wilmington, Del.

Copper-Steel Alloy.

Schneider & Co., of France, manufacture steel containing a variable portion of copper, which is to be used in making artillery of large caliber, armor plates, rifle barrels, and projectiles. Ordinary copper is used for the purpose, care being taken to prevent it from oxidizing before it is mixed with the steel in the crucible, and the composition contains two to four per cent of copper, the alloy being capable of far more resisting power and more elastic and malleable than simple steel would be. This new material will also probably be valuable for making girders for building purposes and ship plates.

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[GENTLEMAN'S MAGAZINE.]

The Quest of Gold.

Independent researches in many parts of the world have conclusively shown that much so-called "alluvial" gold has not been deposited by flowing water, but by water in its solid form, viz., by glaciers. In British Columbia, in the Northwest Territory of Canada, in Nova Scotia, and in New Zealand are many gold placers formed by glacial action. In North Carolina, Professor Kerr, the State geologist, attributes square miles of auriferous gravels to "frost drift" or "earth glaciers," *i. e.*, to the effects of repeated frost and thaw in decomposing the rocks, and then by alternate expansion and contraction causing their detritus to rearrange its component parts. Even in tropical Brazil, the golden *canga* represents what is left of the glacial moraines and *debris* of a past geological epoch. Finally, to come nearer home, gold is found in the "till" on the flanks of the celebrated Lead hills of Scotland. Quite recently it has been claimed that some of the Californian "gravels" are not gravels in the true sense of the word, but that they are partly due to mud volcanoes, much of the accumulated matters being angular instead of rounded, as they are in riverine deposits.

Whatever the means by which the placer gold has been conveyed to its present bed, it can only have had one source—mineral veins. At one time it was the fashion to suppose that vein gold would be found only in quartz rocks of Silurian age, but though such formations do afford a large proportion of vein gold, there are many other minerals which carry gold—notably calcite—and scarcely a rock formation in which one could safely predict its absence. As to how the gold got into the mineral veins there are many plausible theories—in solution, by decomposition, by condensation of vapors, etc. Probably all these may have had their share in its production. Certain it is that gold has been found in solution in sea water, and in native crytals, in the pores of lava which has been ejected within historic times.

Vein mining entails greater expense than gravel mining, because the underground workings are more extensive and more difficult, and when the vein stuff has been mined, the hidden gold can only be got out by the aid of costly machinery, designed to execute in a few hours that which, if left to natural agencies, would occupy many years. Thus a percentage of gold that would be remunerative in a placer would not pay in a vein, but veins are more enduring, and now afford the chief supplies of the precious metal.

When all the circumstances are favorable, gold mining and milling are sufficiently simple operations, but a vast number of enemies arise to trouble the mill man. Two of the worst are known as "float gold" and "floured mercury," and so many shareholders have been robbed of their dividends by these obstructive agents that they will probably be glad to know something of their birth and history. It must be told, then, that sometimes the gold occurs in particles so infinitesimally minute that they will actually float on running water, and thus get carried away with the refuse, despite all contrivances devised to arrest them. In the case of vein gold, this evil is often increased by the hammering action of the stamps, which flattens the grains and augments their buoyancy. By the stamping process also the surfaces of the grains get covered with a silicious coat, due to impalpable quartz powder which is hammered into the yielding metal. This skin prevents proper contact between the gold and the mercury, hence such grains escape amalgamation; even gold which has been simply hammered shows, for some inscrutable reason, a very reduced affinity for mercury. Much gold is naturally coated with oxide of iron, or contaminated with a talcose mineral, or with shale oil, or with steatitic matter, all which are more or less inimical. Even dirty water used in the mill will cause an objectionable sliminess which must be guarded against. Then no ore is quite free from sulphurets (compounds of sulphur with the base metals—iron, copper, lead, zinc, antimony), which rapidly destroy the activity of the mercury by dulling its surface and causing it to break into tiny particles, known as "flouring" or "sickening." Frequently these sulphurets form a considerable portion of the product and contain much of the gold, whose extraction from them is no longer a mere mechanical process, but involves roasting, treating with chemical solutions, and other intricate and delicate operations known to metallurgists. Many a mine really depends for its success upon the adoption of the most suitable method for dealing with the sulphurets, and that method is not always discovered in time to save the company from liquidation.

Sufficient has been said to show that modern gold mining is a highly scientific industry, demanding capital and skill. A rich ore is by no means synonymous with large profits. The presence of gold is a necessary element of success, but equally essential elements are the tractable character of the ore, the situation of the mine, the supply of water and fuel, and the labor question. The problem is a commercial one, how much gold can be got from a ton of ore, and at what cost? To illustrate this by one example. Many mines assaying over 1 ounce (20 pennyweights) of gold per ton have failed to pay. On the other hand, a well known Australian mine since 1857 has raised over a million tons of quartz, the bulk of which averaged only 6½ dwt. per ton, and some less than 4 dwt., yet it has yielded gold to a value approaching two million pounds sterling, and has repaid the original capital many times over in dividends.

One of the great charms of gold mining as an investment is that the market value of the product is constant, there are no fluctuations in the price of gold as there are in those of other metals, hence a soundly established undertaking can never fail through depressed markets. Only get your gold, and it will sell itself.

The Edison Exhibit at the Paris Exhibition.

PARIS, May 15, 1889.

The Edison exhibit forms a most important and attractive display, the more so as it is already practically complete. No one who examines this remarkable display can fail to be struck with the wonderful versatility displayed in the inventions of Mr. Edison. That one man alone should be the originator of no less than 493 patents, besides the 300 more applications for patents in his name, which are still pending, is marvelous enough, but the wide range of applications covered by the patents is still more astounding. The exhibits comprise the most recent apparatus in all the leading branches of Mr. Edison's inventions, and may be classed under the following heads: Telegraphic, telephonic, phonographic, physical, electric lighting, underground conductors, lamp manufacture, the electrical separation of metals, and electric meters. We will first take a rapid glance at the principal objects of interest, deferring a more detailed examination until a later date.

In the telegraphic section we find at work the latest bridge quadruplex system, now adopted in this country; the duplex system, the phonoplex system of signaling, in which a form of telephone is used as a sounder; train telegraphs, the automatic telegraph, by which a speed of 1,500 words per minute has been obtained. The last named instrument is capable of transmitting either Roman letters or Morse characters, the former requiring five and the latter three wires. The five-wire system is the most generally adopted, the message being put into the transmitter by a punched slip moving over a metal roller. The roller is rotated rapidly by an electric motor, and the contacts between the battery and line are made through the perforations in the slip. At the distant end the currents produce by chemical action corresponding symbols to those transmitted. This system was operated for some years between New York and Philadelphia and New York and Washington by the Automatic Telegraph Company and the Atlantic and Pacific Telegraph Company; and later, upon the absorption of these companies by the Western Union, it became the property of the latter. There are also exhibited the harmonic telegraph, stock printers, district messenger system, motograph relay, carbon relay, and rheostat. The motograph relay, which operates a local sounder or Morse circuit, is a marvel in itself. The contact closing the local circuit is attached to a spring resting on a rotating chalk cylinder, and the principle of the reduction of surface friction between the spring and the cylinder on the passing of a current through them, which was applied by Mr. Edison to his loud-speaking telephone, is here applied, the spring responding in lateral movement to the successive currents received. The cylinder is driven by a small electric motor with worm gearing, rendering the instrument, therefore, self-contained.

In illustration of the same principle we find several instruments in the physical section which have been made specially for the show, among which we may mention one in which the experimenter holds a brass spring with a palladium tip, and slides the tip along a surface composed of blocks of various metals in succession. The current being passed through the metallic surface and the spring, a difference can be felt in the surface friction according to the different metals in contact with the spring. In this section also there are experimental incandescent lamps fitted with a central platinum wire between, but not touching the sides of the carbon filament, to show the "Edison effect," which is, that, while the lamp is burning, a galvanometer, or even a sounder, inserted between the positive terminal of the lamp and the isolated platinum wire is actuated every time the sounder circuit is closed. In this section is also shown the megophone, which is an apparatus for concentrating waves of sound and rendering speech possible at a distance of three miles. There are two large cone-shaped receivers, 7 feet long, and tapering down from 2½ feet diameter at one end to 1 inch at the other. A speaking trumpet, with an orifice 6 inches diameter, is fixed between the two receivers.

In the electric lighting section is exhibited a complete central station plant on the three-wire system. Everything will be installed according to the latest methods. The two similar dynamos to be run with this station are each of 125 volts and 240 amperes, and run at 1,200 revolutions. Each machine weighs 4,340 pounds. The machines are shunt wound, and can be regulated as to their potential by an adjustable resistance inserted in series with the shunt wire. The three mains, or "omnibus" wires, are conducted from the machines to the distributing board, whence the connections to the various feeders are made.

These details of the central station system really demand separate treatment, and we must defer our description until we can enter exhaustively into the subject with the aid of diagrams. For the present we may say, however, that the underground conductor system is very fully shown, the conductors leading from the central station actually being laid down in pipes according to the latest method. Mr. Edison's original method was to inclose the bare copper mains in iron pipes, and retain their distance apart by passing the mains through pieces of thick millboard placed at intervals along the pipe. It was found, however, that it was necessary to connect together the millboard supports by string, in order that they should retain their relative positions during the running in of the insulation compound. The improvement effected and now employed consists in wrapping each conductor of bare copper round with a separate spiral of rope, which acts as a separator between the mains, and afterward an outer wrapping of rope round the outside of the conductors, which keeps their position central in the pipe and separates them from contact with it.

The process of lamp manufacture and the Edison electrolytic meter system is shown in great completeness by means of specimens of the actual materials throughout the various stages.

Mr. Hammer, to whom the design of the huge model Edison lamp and the flashing effects in incandescent lamps which are to be exhibited on its pedestal are due, intends, we are glad to hear, to reproduce the marvelous effect of transformation of sound through the medium of two Edison phonographs, two carbon telephones, two motograph receivers, and two induction coils, which he demonstrated with such success at his lecture in the Franklin Institute, Philadelphia, between that place and New York.

I may mention that over the American Section, in the Machinery Hall, an inscription has been put up stating that the United States possess steam engines of 450,000 horse power, the power of which is transformed into electrical energy; and that, apart from transmission of power, this energy is used to supply current nightly to 2,000,000 incandescent lamps and 250,000 are lamps.—*Correspondence of the London Electrician.*

Phosphorescent Powders and Luminous Paints.

E. Becquerel (*Comptes Rendus*) has lately added to his former communications upon this subject some very interesting observations of a practically useful kind. It is now well known that although a slightly phosphorescent powder may be obtained by calcining together in a closed vessel sulphur and pure carbonate of calcium, yet the presence—as "impurities" or otherwise—of extremely small proportions of other substances, often greatly enhances the "lighting" powers of the resulting compound; again, traces of certain metals seem to destroy or greatly diminish the phosphorescent effect. We may usefully condense some of the author's results in the following manner, thus: 1. Sulphur and pure carbonate of calcium give very slight phosphorescence. 2. Sulphur and pure carbonate of calcium, plus 0·5 to 1·5 per cent soda, give brilliant green phosphorescence. 3. Sulphur and pure carbonate of calcium, plus traces manganese or bismuth, give little or no phosphorescence. 4. Mixture as No. 3, but with 1 per cent soda, gives strong yellow or blue phosphorescence. 5. Mixture as No. 1, plus traces of lithia, gives intense green phosphorescence. 6. Sulphur and oyster shells, etc., give red phosphorescence. 7. Mixture as No. 1, plus traces of rubidium, gives red phosphorescence. 8. Sulphur and pure carbonate of strontium give very faint bluish green phosphorescence. 9. Sulphur and pure carbonate of strontium plus soda give bright green phosphorescence. We see from the above, for the first time, something of the reason why marine shells give such good results. They contain traces of rubidium, and Becquerel shows that the salts of this metal exert a powerful effect. From the real cause of the luminosity of these impure sulphides, however, how they act in "bottling up sunshine," and why certain other substances influence this property so much, we are as far off as ever. The entire subject of phosphorescence is, at present, not "luminous," but very obscure.

A PHOTOGRAPH of a curious hen's egg has been sent us by C. G. Moore, of Crawfordville, Ga. It was a double egg. It appeared to be an ordinary egg united; it was cooked and broken open, when, to the surprise of every one, instead of finding a yelk, it was discovered that there was a perfectly formed egg within the outer shell. The inner egg seemed to be perfect, and contained the usual white wall and the inner yelk, which was, however, quite small. It was considered such a curiosity that Mr. Moore had a photograph taken and sent us.

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Correspondence.

Phosphor-Bronze Wire for Mechanical Telephones.

To the Editor of the Scientific American:

In your issue of May 18 you describe a cheap telephone. I would suggest the use of phosphor-bronze wire, same gauge, as being far superior to copper. I have had considerable experience with the same. I used copper wire at first, but had considerable trouble in keeping it tight; the wire would finally get so thin that it would break.

I have used phosphor-bronze wire for about three years on one short line of about three hundred feet, and it has remained perfect. I use ferrotype plate for my diaphragm, having a rubber insulator between button and diaphragm. In the center of my line, at an angle, I have a weighted pulley that keeps the wire tight continually. This pulley plays an important part in winter, when the wire is covered with ice, yielding to the weight until relieved, when it immediately resumes its former position. WM. R. CALVERT.

Saint Davids, Del. Co., Pa., May 20, 1889.

The Harlequin Snake.

To the Editor of the Scientific American:

Your description of the venomous snakes of America is undoubtedly correct, except so far as the harlequin snake being non-venomous. It is generally calle throughout Texas the king snake, because it easi whips the rattlesnake and masters all other snakes though the name "king" is undoubtedly an error.

During the sixties, a three year old child of Alexander Stringer, living in Corpus Christi, Texas, caught one of them in the yard and brought it into the house in its hands, and was bitten in the face, near the lip, by it. Inflammation followed, and in a very short time the child died, having suffered intense agony. There can hardly be a doubt but that the child died from the bite of the (king) harlequin snake. I have heard of many other instances of the deadly venom of the harlequin snake, but the instance mentioned is the only one I can verify, as I lived in Corpus Christi at the time of the child's death and examined into the matter quite critically, as I was then editor of the Corpus Christi *Ranchero*, a newspaper.

The (king) harlequin snake is considered more deadly than the rattlesnake, from its bite, and it grows to a larger size than is indicated in your article on venomous snakes. H. A. M.

Brownsville, Texas, May 17, 1889.

[I think H. A. M. is mistaken in regard to the harlequin snake (*Elaps*). The article referred to distinctly says that it does possess poison fangs and is a venomous species, nearly related to the cobra. That, nevertheless, it is looked upon as a harmless and inoffensive little serpent in many portions of the Southern States, I am certain. Dr. Holbrook, of Charleston, S. C., and others, say that it is generally considered harmless. That it may be dreaded in portions of Texas I have no reason to doubt.

H. A. M. has evidently confounded two very different species of serpents. He says that the harlequin snake is generally called the "king snake" throughout Texas, because it easily vanquishes the rattlesnake and masters all other serpents. The average length of the Texan harlequin (*Elaps*) is about two feet, and one measuring over three feet is unusually large and the body at its thickest portion is rarely much thicker than a man's finger. Now, the supposition that this diminutive serpent attacks and conquers the large and powerful rattlesnake (*Atrox*) and the swift and vigorous black snakes, is to my mind absurd. The true king snake (*Ophibolus getulus*), however, is an entirely different serpent. It is black in color, crossed by about thirty narrow yellowish lines which fork out on the sides of the body. It has been found from New Jersey to Mississippi. Say's king snake (*Ophibolus getulus* var. *Sayi*) is common in many parts of Texas and adjacent States. The ground color above is lustrous black, each scale above with a white or yellowish spot in the center. Sometimes these spots cross the back in more or less regular lines. Beneath white or yellowish, with broad black blotches. They grow to a length of four feet and over, are active and powerful serpents, more or less constrictors, but without poison fangs, and consequently non-venomous. Say's king snake has been killed in the act of swallowing a moccasin snake, and other species of *Ophibolus* have frequently been taken with partly swallowed serpents in their mouths or doubled up in their stomachs, the victim in some cases being nearly as large as the swallower. It is generally admitted that the *Ophibolus* does not attack other snakes merely for sport, but for the purpose of securing a meal.—C. FEW SEISS.]

To Keep off Mosquitoes.

Take a small quantity of a two per cent carbolic acid solution and sprinkle sheets, coverlets, pillow, and bolster on both sides, the edges of bed curtains, and the wall next the bed. The face and neck may also be slightly wetted with the solution. Not a single gnat or mosquito, it is said, will come near.

Care of Fire Extinguishing Apparatus.

Some timely warnings—one of a most unfortunate character—have been recently sounded, calling attention to the necessity of taking care of fire apparatus. All over the country are villages and cities which for protection rely upon a volunteer or more or less efficient paid fire department. In some of these settlements fires may never have occurred. The natural consequences of disuse accordingly tend to overtake any fire engines, hose, etc., which they may possess. Years ago, it may be, a subscription was started and fire equipment was purchased. For a year or so the enthusiasm would last, and it would be carefully kept. But gradually the feeling of interest would die out and the effects of rust and decay would make themselves felt, and in the course of time the elaborately painted engine, hook and ladder truck, or hose carriage would be nearly useless, the hose couplings would become so corroded that they could not be screwed together, and the hose would become so buckled and stiff as to be incapable of effective manipulation.

The above is no imaginary picture. In a Massachusetts village the chief engineer of the fire department, in his annual report, calls attention to the bad condition of the fire ladders. They are, he says, "old, heavy, worm-eaten, and unfit for use." The same, we doubt not, could be said for many other pieces of apparatus in villages all over the land. From Washington, he new State just added to the Union, comes the re- of a fire that swept away the greater portion of business portion of Cheney. The fire apparatus was drawn out and the hose was attached to the engine, when it was found that the nozzle was plugged with wood. Many thousands of dollars' damage was done because the fire gained such headway before the plug could be extracted that it could not be checked. The need of daily inspection was here emphasized.

The many thousand sufferers by the Johnstown disaster received warnings enough to have saved every life if acted upon, but they had come to regard them as an old story, so often had they been repeated in the past. Thus it is with the unused fire engines and general life and property saving appliances. The warning in the shape of danger from fires is ever present, and is disregarded. When the danger is realized, and a conflagration actually occurs, the fire guardians find themselves unprepared to cope with it.

Holy Land Railway.

Application has been made by Jos. Elias, formerly government engineer of the Lebanon, for a concession for a railway from Haifa, on the Mediterranean, about midway between Tyre and Cæsarea, by way of Lake Galilee, over the river Jordan to Damascus. Authority for the navigation of the lake and a priority of right for the extension of a line over any other applicant for three years is asked for. The line is to follow the river Kifhon for six miles, going within three and three-quarters miles of Nazareth, and then ascending the valley to the watersheds of the Jordan. The line will proceed along the northwest of the lake close to the plain of Genesaret, up the Jordan, crossing it about two miles below Merim. From that point the line turns toward the east to Damascus, a distance of one hundred miles from the coast. A branch line will go to Naova, the capital of the Hauran, with an option to continue on to Bosra, the ancient capital of Bashan.

The practical part of Mr. Elias' application is interesting. He estimates the population to be served at 500,000, or about 5,000 to the mile. Damascus has about 200,000 inhabitants and there are ten towns with from 1,000 to 10,000 inhabitants and about 5,040 villages. Although the district is very fertile, only one-sixth of the arable land is under cultivation. There is an abundance of streams, however, so that the country could be easily irrigated.

The Effects of Carbonic Oxide upon the Blood.

A statement by Professor W. P. Mason, of the Rensselaer Polytechnic Institute, respecting the poisonous character of water gas appears in a recent issue of the *American Gaslight Journal*. He refers to an event in the history of Troy, in the State of New York, where owing to a break in the street mains a quantity of fuel gas passed underneath the frozen crust of earth and percolated into the adjoining houses, causing four deaths and many more or less serious illnesses. The composition of the gas by volume was: Carbonic acid, 5; oxygen, 0·5; carbonic oxide, 37·5; light hydrocarbon, 0·9; hydrogen, 48; nitrogen, 7·1. It was practically odorless; and gave no warning of its presence in dangerous quantity in the atmosphere of the houses. The unconscious victims died without any struggle, their appearance when found indicating that the insensibility which passed into death overtook them without creating any previous alarm, or disturbing them from their occupations and attitudes at the moment of seizure.

What is most remarkable is that fires were burning and lamps lighted in the rooms invaded by the poisonous gas, which was therefore strong enough to kill without being strong enough to form an explosive mixture. Very searching *post mortem* examinations of the victims were made without disclosing anything abnormal, with the exception of the bright cherry red color of the tissues and the vivid redness and fluidity of the blood. When the operating surgeon opened the chest cavity, he endeavored to detect any unusual odor, and was immediately affected with giddiness, and the subsequent oppression did not wear off for twelve hours. A lawsuit followed the accident, and Professor Mason was retained to analyze and experiment upon the fuel gas and its effects upon living animals. In this way the analysis already given was made. It is placed upon record by Professor Mason that, both microscopically and by the spectroscope, the effects of carbonic oxide poisoning may be detected in a sample of blood kept in a bottle and not examined for a year after the death of the animal from which it was taken. Even after two years such a sample of blood will still retain the characteristics noted when first inspected.

Iron Shafts.

A revulsion of feeling regarding the supposed superiority of steel over iron for heavy shafts for steamboats has been gaining strength for some time, and it is said that nearly all steel shafts that break nowadays are being replaced by iron. It is also stated that those made by Krupp, the German iron worker, have fared no better in builders' estimation than some made in this country.

Considerable inquiry was made on the subject recently, and the only one who gave a good word for the steel shaft was Mr. David Shaw, superintendent of the steel works at Chartiers. He stated that he thought good steel would answer the purpose, but that some kinds would be no better than pig iron.

Mr. James A. Henderson stated that the shafts on the Scotia, Katie Stockdale, John Moran, and Beaver had all been replaced lately with iron. Mr. Henderson explained that steel seemed to be affected something like French plate glass. When a fracture is made in the latter, it continues to extend, unless a hole be bored at the end thereof, and the manner in which the particles of steel were pressed together appeared to deprive them of tenacity or coherence.

Mr. Henderson instanced the familiar experience of finding broken iron axles on various kinds of vehicles, where it is often seen that the axle has been doing duty for a long time partially broken, the old fracture being plainly visible. With steel it is different. When a shaft begins to give way, the fracture extends rapidly.

Iron shafts have been known to do duty for a quarter of a century, doing good service long after the fissure began to yield.

A gentleman at the office of Carnegie, Phipps & Co. stated that they had made quite a number of iron shafts for steamboats lately. He attributed their superior strength to the fine quality of iron used in making them and to their superior torsional strength.—*Pittsburg Dispatch.*

Detecting Minute Quantities of Iron in Minerals.

Alexander Johnstone, F.G.S., Assistant to the Professor of Geology and Mineralogy in the University of Edinburgh, states, through the columns of the *Chemical News*, that a new and rapid method for detecting minute quantities of iron in minerals is easily accomplished as follows:

By means of a good strong flame, produced in the ordinary way by the mouth blowpipe, heat for a minute or two a small portion of the mineral, preferably in a powdered condition, on *clean* platinum foil, with about four times its bulk of potassium nitrate or chlorate. The platinum should be heated from below, as it is not desirable that the flame should touch the assay. After the mass has been ignited as stated, add to it, *before it has cooled down*, by means of a piece of glass tubing, *pure* concentrated nitric acid drop by drop, until a single drop remains not dried up. Next pour on to the top of the unevaporated nitric acid, also by means of a narrow glass tube, two or three drops of an aqueous solution of potassium sulphocyanide. A *distinct* red coloration will immediately arise and remain if any iron was present in the mineral examined. As this test is extremely delicate, nitric acid quite free from iron must be obtained; and it is essential that the potassium nitrate or chlorate should also be pure. The platinum foil must be perfectly clean, and the dropping tubes must be rinsed with water before and immediately after the application of each test.

American Machinery Abroad.

It is a remarkable fact, observes the *Iron and Steel Trade Journal*, London, that in the manufacture of different kinds of machinery the Americans can beat us in price. Wages in the United States are about 50 per cent higher than in this country; materials are from 25 to 50 per cent dearer; yet the finished machines can be put on the market cheaper. It is true that the Americans cannot send out machines to neutral markets any cheaper than is done by our manufacturers; but it is surprising that they can at least meet us in price.

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THE PARIS EXHIBITION—THE EIFFEL TOWER.

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LYNX IN THE BERLIN ZOOLOGICAL GARDEN.

The Egyptian lynx (*Lynx chaus*) in the Berlin Zoological Garden, from which the accompanying illustration was drawn, is about the size of a wildcat. The color of its rich fur is pale gray, with a shimmer of brown, but without any decided ground color; the cause of this peculiarity being the marking of the separate hairs, which are yellow at the root, have a black ring in the middle and have white, gray or black tips. His head is like that of a large cat, and his ears, which are grayish yellow on the outside and reddish on the inside, bear the characteristic mark of the lynx, little brush-shaped tufts of hair; the jaw and teeth are very strong.

The *Lynx chaus* inhabits most parts of Africa and Southern and Western Asia, but is found chiefly in the countries bordering the Caspian Sea, Persia, Syria, Nubia, and Egypt; in the last of which it is often hunted. Modern explorers and tourists in Egypt seldom miss a hunt for this game. The lynx is one of the animals which, thousands of years ago, were embalmed and buried in sacred places by the Egyptians. Brehm writes of the swamp lynx: "He is no rarity in Egypt, but is not often seen. In those countries there are no large forests in which a beast of prey can conceal himself, and therefore it is necessary for him to find other hiding places. The hyena usually has its den in the clefts of the wilderness, but often lives for a long time in a reed bed, the jackal and fox hide in reed grass or grain, and the lynx also lives quietly in similar places. His favorite haunts are the Nile-watered grain fields, but he also inhabits the great plains, which are more or less thickly covered with tall, sharp reed grass (*Poa cynosuroides*). Like all wild cats, the lynx creates great havoc among the birds; he also catches rats, mice, and young hares, but his principal food consists of the members of the feathered world, which he kills without regard to the beauty of their plumage, or other good qualities. He creeps noiselessly upon his prey, and often springs into the air to catch it. He steals doves and fowls from farmyards and, consequently, is feared and hated by the fellahs. Young lynxes have been tamed.—*Illustrirte Zeitung.*

LYNX IN THE BERLIN ZOOLOGICAL GARDEN.

THE EIFFEL TOWER.

We give herewith an engraving of this great work, for which we are indebted to *L'Illustration*, and from *Engineering* we gather the following particulars:

The Eiffel Tower is the natural development of the class of work upon which its constructor has been occupied for so many years; it was the direct outcome of a series of investigations undertaken by M. Eiffel in 1885, with a view of ascertaining the extreme limits to which the metallic piers of viaducts could be pushed with safety, this special line of investigation having reference to a proposed bridge with piers 400 ft. in height and 140 ft. of base. The idea of the great tower followed, preliminary plans were prepared, and calculations made by two of M. Eiffel's principal engineers, MM. Nouguier and Koechlin, and by M. Sauvestre, architect. Naturally the leading principle followed was that adopted by M. Eiffel in all his lofty structures, namely, to give to the angles of the tower such a curve that it should be capable of resisting the transverse effects of wind pressures without necessitating the connection of the members forming these angles, by diagonal bracing. The Eiffel Tower, therefore, consists essentially of a pyramid composed of four great curved columns, independent of each other, and connected together only by belts of girders at the different stories, until the columns unite toward the top of the tower, where they are connected by ordinary bracing. Iron, and not steel, was used in the construction throughout.

There are four independent foundations, each standing at one angle of a square, about 330 feet on a side; the two piers nearest the Seine were known as numbers 1 and 4, those adjoining the Champ de Mars as 2 and 3. On the site of the two foundations 2 and 3, the bed of gravel was met with 23 ft. below the surface; the thickness at this point is about 18 ft. The conditions for obtaining a good foundation were therefore extremely favorable, and the piers were built upon a bed of cement concrete 7 ft. in thickness. The two piers nearest the Seine required different treatment. The bed of sand and gravel was only met with about 40 ft. below the surface, that is to say, about 16 ft. lower than the mean water level of the Seine, and it was overlaid by soft and permeable deposits. Excavations were pushed, by means of caissons and compressed air, to a depth of about 52 ft. below the surface, and it was found that, under the gravel, variable deposits of fine sand, formed of limestone and sandstone, had accumulated, having been left there by the water after the clay had been washed out in hollows by the stream. Owing to this there existed a good and incompressible bed about 10 ft. thick under the western pier on the Grenelle side, and nearly 20 ft. thick under the north pier on the Paris side. Apart, therefore, from the difficulties in sinking for the foundations, the conditions were very satisfactory. The mode of sinking adopted was that of compressed air, with iron caissons 49 ft. 2 in. long by 19 ft. 8 in. wide; four such caissons were required for each pier, and they were sunk to a depth of 40 ft. below the surface, or 16 ft. lower than the Seine mean water level.

The tower terminates at a height of 896 feet above the ground, with a platform about 53 feet square. The width of the column at this level is 33 feet, the gallery being carried by brackets which are sufficiently wide to afford a considerable area of platform. It is almost unnecessary to state that this space is securely protected by a railing and glass to prevent any voluntary or involuntary catastrophe. Above the platform rises the campanile, which is of the design shown; in the lower part of this is established a spacious and very completely fitted laboratory, closed to the public and intended for the prosecution of scientific research and observation. Four latticed arched girders rise diagonally from each corner of the lower part of the campanile and unite at a height of about 54 feet above the platform. By means of a spiral staircase yet another gallery is reached, about 19 feet in diameter, and surrounding the lantern which crowns the edifice and brings the height of the structure to 984 feet. Above this rises the great lightning conductor. Within the lantern, which is 22 feet high, will be placed a very powerful electric light, placed within a lantern of the first order, and projecting white, blue, and red beams. Reflectors will throw these beams over Paris, and will help to illuminate the Champ de Mars.

Provision is made for protecting the structure from the effect of lightning by means of cast iron pipes, 19 inches in diameter, and passing through the water-bearing strata below the level of the Seine for a distance of 60 feet. At one end these pipes are turned vertically, and are connected with the ironwork of the tower. There are eight pipes in all, two for each column.

The total weight of wrought and cast iron that has been used in this unique structure is 7,300 tons, not including the weight of the caissons employed in the foundations nor the machinery installed for working the elevators.

No doubt during the period that the exhibition is kept open the ample facilities thus provided for the public will not be found excessive, but it is scarcely reasonable to suppose that after all the buildings on the Champ de Mars have been swept away, and the vast column alone remains to suggest the glories of the departed centennial celebration, great numbers of visitors will go so far out of Paris as the Champ de Mars to enjoy a sensation which by that time will have ceased to be novel. It is to be hoped that, by the time the exhibition closes, the enterprising syndicate which has acquired the Eiffel Tower will find themselves repaid to a large extent. Otherwise there is reason to fear that their speculation may not turn out profitable, and that their twenty years' concession will scarcely suffice to make their speculation a satisfactory one.

But of course the tower has other uses than that of money making, some uses which are now apparent, and others which the existence of the structure will suggest as time goes on.

We may conclude this notice with a few miscellaneous particulars of this interesting work. The total weight of iron employed in the structure itself is 7,300 tons. The weight of rivets is 450 tons, and their total number 2,500,000. Of this quantity 800,000 were riveted up by hand on the tower itself, during the work of fixing together the finished pieces which had been completed at M. Eiffel's establishment at Levallois-Perret, and which were delivered on the Champ de Mars ready for erection. The number of pieces of iron of different forms is 12,000, and each of these required a special drawing; there were thus no less than 12,000 working drawings sent into the workshop, to say nothing of the innumerable sketches and plans prepared before the final details were decided upon. The total thrust upon the foundations is 565 tons, not including the effect of wind, and 875 tons under a maximum wind pressure. The tower is painted of a rich chocolate color, the tone of which is lightened from the base toward the summit. The painting, which was of itself a considerable work, is very effective, especially when lighted by the sun. But little decoration has been attempted; it would have been wasted labor and expense. The level of the first story is marked by a bold frieze, on the panels of which, around all four faces of the tower, are inscribed in gigantic letters of gold the names of the famous Frenchmen of the century who have most contributed to the advancement of science.

"It is as it were under their patronage that this monument is erected, and the constructor has desired to consecrate to them the place of honor, and upon it to write their names in letters of gold, as an evidence of public recognition, and as of homage paid to their efforts, without which such an enterprise could never have been attempted."

Above this frieze the four-sided arcade, covering the exterior gallery, is elaborately decorated, and considerable exception has been taken to this feature as marring the bold and graceful outline of the tower. A similar arcade encircles the tower at the level of the second story, and the same objection may be raised with regard to it, but with less force, because the great height

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makes the arcade look insignificant. The sloping arches and spandrel fillings which connect the columns of the tower on the four faces beneath the first story are singularly well adapted to the gigantic scale of the work.

Very careful observations were made from time to time as the erection of the tower advanced to check its verticality. These observations showed conclusively that the foundations had not yielded at all under their very moderate load, and that if any deviation from the vertical existed, it was so slight as to be scarcely appreciable with the most careful measurement. All the other calculations of M. Eiffel have been so complete and accurate, and his experience with high structures so exceptional, that his assurance may be taken with confidence that the oscillations of the tower at the summit under the most unfavorable conditions of wind pressure will not exceed 6 inches, while the periods of vibration will be relatively slow. Under ordinary conditions of weather the tower will remain absolutely rigid.

The success of the many problems attending the erection of the tower has been complete, and does M. Eiffel much honor.

The remarkable regularity with which this erection has been accomplished, and the fact that no correction of any kind was ever required, is an ample proof of the precision with which the innumerable parts that compose the structure were turned out from the ateliers of Levallois-Perret. This achievement also shows how well the arrangements for the erection were combined, all having come to pass as had been foreseen, without error, without accident, and without delay.

To obtain such a result, M. Eiffel has been admirably seconded by MM. Nouguier and Koechlin. M. Nouguier, who is chief engineer to the Eiffel firm, had the entire management of the erection of the famous bridge over the Douro (Portugal). He and his colleague, M. Koechlin, are well known for their entire competence in matters regarding iron structures, and have for twelve years taken an active part in all the works achieved by M. Eiffel.

Horse Power and Sails on Early Railways.

According to *Engineering News*, a correspondent of the Washington *Star* has been ransacking the national museum for some of the earlier motors on railways, the experiments of a period when the steam locomotive was still looked upon with doubt and distrust. He says that in 1829 a Mr. C. E. Detmold contrived, for use on a South Carolina railway, a car propelled by an endless chain attachment worked by a horse, treadmill fashion. This car, the "Flying Dutchman," ran on this road for some time and attained a speed of 12 miles per hour. A similar expedient had been previously tried on the Baltimore & Ohio Railroad; but as it worked indifferently well, and on one occasion ran into a cow and dumped a lot of editors into the ditch, the press of that region was unanimous in pronouncing the experiment a practical failure.

After the horse experiment, the Baltimore & Ohio road next had recourse to the wind as a motor, and a sailing car, known as the "Meteor," was invented by Evan Thomas, and ran for some time "whenever the wind was favorable." This car made good time with the wind abaft or on the quarter, but with the wind abeam it would capsize at times, and no wind at all caused some provoking delays. The Charleston *Courier* of March 20, 1830, describes as follows an experiment with a sailing car on the South Carolina Railway:

"A sail was set on a car on our railroad yesterday afternoon in the presence of a large concourse of spectators. Fifteen gentlemen got on board and flew off at the rate of 12 to 14 miles an hour. Thirteen persons and three tons of iron were carried about 10 miles an hour. The preparations for sailing were very hastily got up, and of course were not of the best kind, but owing to this circumstance the experiment afforded high sport. The wind blew very fresh from about northeast, which, as a sailor would say, was "abeam," and would drive the car either way with equal speed. When going at the rate of about 12 miles an hour and loaded with fifteen passengers, the mast went by the board, with the sail and rigging attached, carrying with them several of the crew. The wreck was descried by several friendly shipmasters, who kindly rendered assistance in rigging a jury mast, and the car was again put under way. During the afternoon the wind changed so as to bring it nearly ahead when going in one direction, but this did not stop the sport, as it was ascertained that the car would sail within four points of the wind. We understand it is intended by some of our seamen to rig a car properly, and shortly to exhibit their skill in managing a vessel on land."

Sail cars have been used on the level roads of Holland, Spain, and China. C. J. Bascom, of the Kansas Pacific road, constructed a car with a mast 11 feet high, having a triangular sail with two booms. With a favorable wind it would speed over the plains at the rate of 40 miles an hour. At Barnegat beach railroad men frequently hoist a sail on construction cars and take advantage of the wind. On the Maiden Island, in the South Pacific, a tramway 5 miles in length, constructed for the purpose of bringing guano from the guano fields to the harbor, is operated by sail power and by hand. The trucks are pushed up to windward, loaded, and then sail is made and the train moves along at a fine rate. On these islands there is nearly always a fair wind. The locomotive truck carries a single mast in its center, rigged with a large sail.

Vesuvius in Eruption.

Recently Vesuvius has been more active than usual. Numerous convulsions in the interior resulted in the rending and then the collapse of the last new cone at the top of the mountain. "We are so used," the Naples correspondent of the London *Daily News* says, "to these changes at the extreme summit that it is no new thing to see from Naples that the point of the active crater has fallen in, and the top of the mountain has been reduced to the flatter shape which is its normal form. On this occasion, a stream of lava issued from the east side of the cone, and was thus invisible from Naples. It ran about one-third of the distance down the entire mountain. . . . I extract the most interesting passages from the report of Signor Scarfoglio, of the *Corriere di Napoli*, who repaired to Vesuvius on May 4, to see, at any rate, the changes wrought by the last eruption, even if he was too late to witness the new lava stream.

"He writes: 'The mountain presented a most magnificent spectacle. A man who had been on the cone on May 3 said that he felt the vibration of the mountain so much that he became sick, and he declares that the motion was accompanied by subterranean thunder. The lava and ashes which fell in obstructed the mouth of the crater, causing it to split at the base of the latest cone on the eastern side. I walked along the edge of this new opening, which is about 60 ft. wide and at least 1,500 ft. long, and descends in a straight line, like a colossal ravine. Its depths are hidden by the sulphurous smoke which ascends from it. The lava has run along this ravine for about a mile, dividing into two streams, one of which has already stopped, while the other is flowing slowly on, a small column of smoke indicating its course. It rolls in the black bed of the old lava, toward San Giuseppe; but this village is still three miles away from the fiery stream, and is in no danger. All shocks of earthquake and explosive sounds have already ceased; around the broken crater the lava is split into larger or smaller crevices, some almost too wide to leap over. Smoke issues from the crater in great abundance, but no more heated matter is being cast up, and the opening is closed by the debris. Who knows where the liquid lava within Vesuvius will find a new outlet? One thing is certain. The mountain is much weakened at the part where the eruption took place, and the side above Resina is the safest.'

"It would seem from this report that, even should the liquid lava within Vesuvius rush upward with such force as it did in 1872, the region toward and around Pompeii would be in most danger, while the thickly inhabited coast at Torre del Greco, Resina, and Portici would be safe. No one can tell whether this last overflow of lava will be the conclusion of the phase of gentle activity of the last few months, or whether it will be the commencement of a still more energetic period."

The Season for Insect Pests.

The caterpillars, which are making their tents earlier this year than usual, owing to the warm spring weather, should be looked after at once. The simplest and perhaps, on the whole, the best way of getting rid of them is to brush off the nests from the trees as fast as they appear, with a long-handled, conical-shaped brush. Early morning or evening is the time when the entire family may be found at home, so that is the best time to destroy the nest.

The codling worm, which infests fruit trees throughout the land, should be looked after at once. There are many ways of getting rid of the pests, but none is believed to be better than spraying the trees frequently with a solution of Paris green.

Of the fly species, the *Country Gentleman* says the horse-fly is the most cruel and bloodthirsty of the entire family. He is armed with a most formidable weapon, which consists of four lancets, so sharp and strong that they will penetrate leather. When not in use they are nicely folded away in a sucker. He makes his appearance in June, and may often be seen in the vicinity of small streams of water. He is said to subsist in part upon an airy diet, and to pass his life harmlessly. Not so the female, for she is armed with six lancets, with which she bleeds both cattle and horses, and even human beings. She lays her eggs in moist places, and, after they are hatched into footless maggots, they make all necessary journeys by stretching and closing the segments of their bodies, their heads being supplied by two hooks, by which they get their food. In process of time this maggot goes down into moist earth, where it reposes for some weeks, after which it bursts the pupa case, and comes forth a large black fly, armed and equipped like its predecessors.

Cattle Branding.

The following paper, by W. M. Goadby, was read at the annual meeting of the Colorado Humane Society, May 21:

It seems proper, at this time, to draw attention to the practice of branding range stock. For many years vast herds of cattle and horses have been pastured on the range, and as the cattle of numerous owners roamed together, it became necessary to resort to branding in order to determine individual ownership.

The method observed is as follows: The stock is rounded up and the calves or colts are taken one at a time into a part of the corral fenced off for the purpose. The herder then throws his lariat so that the noose will encircle the animal's neck, and dragging him to the ground, skillfully holds him, while a comrade uses the branding iron. The branding is occasionally done on the open prairie. Instances are not wanting where the violence of the fall has broken the animal's neck. The pressure of the iron, heated to a red heat, leaves a scar and causes acute pain for some days.

The extent of the practice and the fact that it has existed so long are poor arguments in favor of its continuance. The State Auditor's Report for 1888 shows that the number of cattle in Colorado was, on the 31st of December, 911,989, and the number of horses 170,056, a total of 1,082,045.

The Percheron stallions, the carriage and trotting horses, and certain varieties of milch cows, brought from the Eastern States, have alone escaped branding.

The United States, Australia, and the Argentine Republic are all cattle-growing countries. The question is therefore international. In our own country, where the people are by nature inventive, it ought to be possible to discover a more humane method for the identification of range stock.

Brain Workers.

The *Medical Age* says that the most frequent fault of the brain worker is excessive application to work. "The most intense and fatiguing of toils is pursued almost uninterruptedly, food is neglected, and the claims of exercise and sleep are but imperfectly admitted. Two hours' exercise in the open air, daily, is probably a minimum, and might prudently be exceeded. The brain worker must live sparingly rather than luxuriantly, he must prefer the lighter classes of food to the heavier, and he must be very prudent in the use of alcohol. Tobacco and tea are apt to be favorites with him, and their immoderate use may require to be guarded against. It is a nice question whether he needs more or less sleep than other men. Many men of genius are light sleepers, probably in some cases a misfortune, but there seems some ground for the notion that more than a moderate indulgence in sleep is unfavorable to successful mental effort."

A commentator upon the above remarks says that he cannot fully agree with them. Mental effort, he says, and the Cincinnati *Medical News* agrees with him, causes waste of tissue elements quite as much as bodily exertion, and this demands a full supply of food. What with dyspepsia and absence of appetite, the results of deficient exercise, and the influence of preconceived ideas as to the use or disuse of special articles of food, the brain worker is very apt to receive too little nutriment to make up for the waste. Especially is this the case when he, unconsciously, perhaps, replaces food by the use of tobacco, tea, alcohol, or opium.

Some advise to go supperless to bed. This most medical authorities of the day think is a wrong notion. It is a fruitful source of insomnia and neurasthenia. The brain becomes exhausted by its evening work, and demands rest and refreshment of its wasted tissues, not by indigestible salads and "fried abominations," but by some nutritious, easily digested and assimilated articles. A bowl of stale bread and milk, of rice, or some other farinaceous food, with milk or hot soup, would be more to the purpose. Any of these would insure a sound night's sleep, from which the man would awaken refreshed.

Drilling Cast Iron.

Mr. L. B. Breckenridge, the instructor in mechanical engineering in the Lehigh University, has lately been making some experiments for the determination of the pressure exerted in drilling cast iron. He made a cylinder in which was a plunger having an area of 10 square inches. Three small grooves were turned in the plunger near its lower end so as to prevent any leakage of the oil with which the cylinder was partly filled. Two holes were drilled in the cylinder near the bottom, and a steam gauge and an indicator were attached. The indicator cord was attached to the hub on the shaft of the quick return motion lever in order to obtain diagrams of considerable length. When the piece to be drilled was resting on the plunger, a diagram could be taken which would show the pressure exerted in forcing the drill through the work. With ¼ in. twist drills the greatest downward pressure was 400 lb.; with ½ in., 900 lb.; with ¾ in., 1,100 lb.; with 1 in., 1,450 lb.; and with 1¼ in., 1,800 lb.

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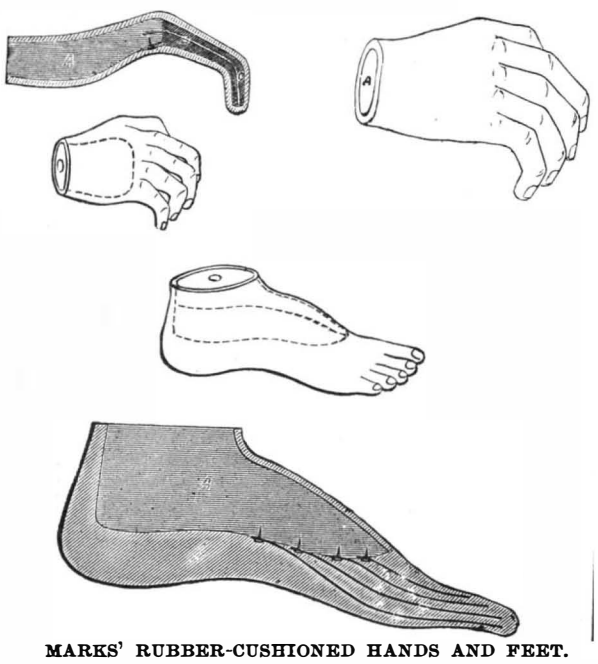
ARTIFICIAL LIMBS.

The Franklin Institute, of Philadelphia, has been given the privilege of awarding a money premium of $20 and a medal, at certain periods, for the encouragement of "ingenious men and women who make useful inventions," this award being from the interest on a sum of money left in trust to the city of Philadelphia by John Scott, of Edinburgh, Scotland. The Committee on Science and the Arts, of the Franklin Institute, which considers all claims for an award of the John Scott Legacy Medal and Premium, has recently recommended the granting of nine different awards under the legacy, one of these awards of the medal and premium being to A. A. & Geo. E. Marks, of 701 Broadway, New York City, for their "improvements in artificial limbs." In an abstract of the report of the committee, published in the *Journal* of the Institute, it is said that the first improvement consisted in the substitution of an elastic artificial foot, made of India rubber, without any joints whatever, for the artificial foot, previously made of wood, with joints to permit motion of the ankle and toes, and also an artificial hand made of India rubber, simulating the missing member. As a matter of course, such an artificial hand, which is here illustrated, could do little else than restore appearances. It had, besides this, the merit of not wearing out gloves and other apparel as rapidly as its wooden and metallic articulated predecessors, and it was much less costly and not so unpleasant when it came into personal contact. The rubber foot, which is also here illustrated, consisted of a wooden block rigidly secured or formed with the leg and extending downwardly to within about two-fifths of the distance from the ankle to the sole, and forward to nearly the first articulation of the metatarsus and toes. This block was covered with India rubber, and all the rest of the



MARKS' RUBBER-CUSHIONED HANDS AND FEET.

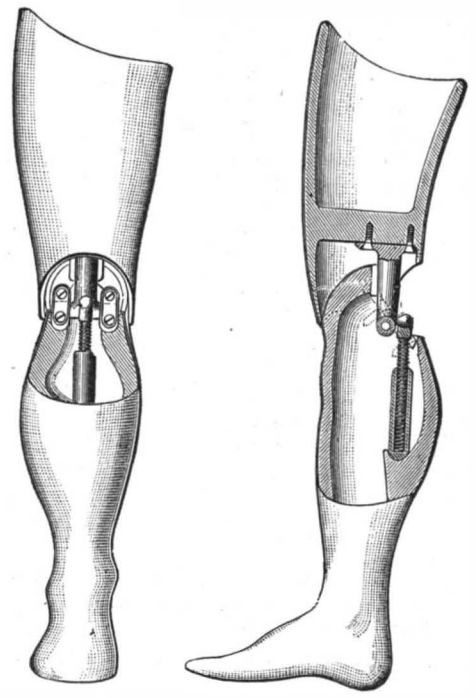
foot, from heel to toes, was formed of elastic vulcanized rubber.

The action of such an artificial foot was that of an elastic segment of a wheel. The shock of placing the weight upon the heel at each step was avoided by the elastic cushion of rubber forming the heel, and as the weight was progressively transmitted to the forward part of the foot, by the combined effect of muscular exertion in the remaining part of the natural limb to which it was applied and the momentum previously acquired, an easy flexure of the toes took place, which, reacting elastically as the weight was transferred to the other limb, assisted in the flexure of the knee joint, giving an easy and naturally appearing movement. Such artificial feet were, upon trial by those who were maimed and had used other artificial substitutes, found to be easier to use, lighter, and more comfortable. They were rapidly introduced into use, and have proved from their greater simplicity more durable and far less destructive to clothing.

The next improvement (the picture of which is here shown) is an improved and simplified construction of the knee joint of artificial limbs, made with a view to strength, facility of accurate manufacture, and easy application. This joint consists of a flanged plate, secured by screws to the under surface of the thigh socket, and has formed, integrally with it, of steel, by drop forging, a cylindrical pillar, terminating in two lateral journals having the same axis, resembling an inverted capital letter T.

These journals perform the function of the condyles of the femur in the natural limb, and are fitted accurately in bearings formed with oblique caps, secured by screws in the rear of the knee portion of the leg.

On the rear of the pillar, in about the same horizontal plane as the axis of the journal when the limb is extended and erect, is formed a short lever, having a spherical end, against which a cup, formed upon the upper end of a sliding plunger, is pressed upwardly by a spring in a guiding cylindrical case, having a hemispherical lower end resting in a correspondingly shaped cup or cavity in a shoulder in the interior of the calf portion of the leg. When the limb is extended, the spring operates with full effect, in holding the limb extended; as it is flexed the lever gradually assumes a greater angle to the line of reaction of the spring and



IMPROVED KNEE JOINT.

cup, so that, when it is flexed with the thigh at right angles with the leg, the spring has no motion or effect, and if flexed still further, the spring then operates to assist in further flexure. The pillar and journals are made hollow, so as to reduce their weight.

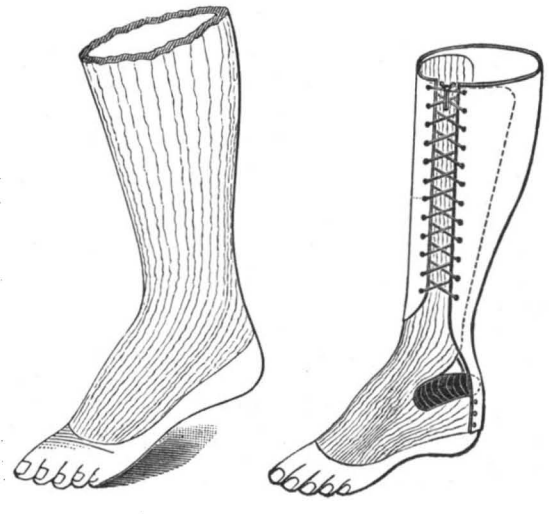
It is obvious to every mechanic, from the form of these parts, that they can readily and accurately be finished by drilling and turning, that from their shape they must possess great strength, and that they can easily be fitted accurately into their working positions in the limbs.

Another useful feature of this form of joint is that the upper part of the pillar forms an effective stop, to arrest the forward motion of the thigh upon the leg during extension, by coming in contact with a cushioned cavity in the rear of the knee; this point of support, being at a considerable distance from the axis of the knee joint, avoids any severe strain and shock from the sudden extension of the limb, which in other constructions, having the stops made in plates at the sides of the joint, are necessarily close to the axis of motion, and consequently are subjected to a greatly increased strain.

This concussion of the stop is found to be a frequent cause of breaking both of the stops and joints of other forms of limbs, and has had a great deal of ingenuity expended upon it to avoid it, by providing check straps or cords reaching from the thigh to the leg, and designed to stretch tight before contact of the stops occurs. These cords required greater care to keep adjusted to the proper tension than could readily be given to them. The simple contrivance here shown obviates the entire difficulty.

The axis of the knee joint is placed near the back of the limb, so that the weight of the wearer insures a firm support on the limb when extended, and at the same time slight exertion suffices to move the limb in stepping forward.

The shell or parts, which in form imitate the natural limb, are made of light willow or basswood, as thin as



TEXTILE FABRICS INCORPORATED WITH RUBBER CUSHIONS.

is consistent with strength in the lower part, and in the upper part excavated to fit the remaining portion of the natural limb; these are covered tightly with parchment and painted and varnished to resemble the complexion of the natural skin.

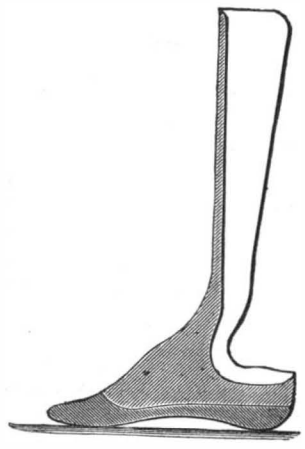
The continued use of the limbs thus constructed demonstrated that the front portion of the foot was too easily flexible, or rather that greater elastic force was desirable, and this requirement was met by the inventor by a device in which a textile fabric was introduced between the lamina of India rubber forming the ball and toe portion of the foot, as here shown in the drawing.

The desire to adapt the India rubber hands to changes of flexure, for purposes of better and more natural appearance and to grasp light objects, led Mr. Marks to improve them by making a light wooden core in the palm or metacarpal portion of the hand, and inserting ductile or flexible metallic wires in such core, which extended centrally through the fingers. By bending the fingers they retain the form in which they are set. The test of several years' use of these last named improvements has proved their utility.

The latest improvement in artificial limbs consists in forming the leg and foot part of a single piece of wood, having the grain curved naturally in its growth, such pieces being procured from the parts of the trunk contiguous to the roots and branches of trees; limbs made in this way are stronger with the same amount of wood remaining in them than when made of parts and glued together, and are made waterproof, which is a specially valuable feature when the occupation of the wearer exposes it to constant dampness, or to water itself, as in fishing, mining, dredging, etc.

By making limbs in this manner from natural curves in the growth of the wood, it has become practicable to make light and substantial artificial feet, adapted to partial amputations of the foot. Such appliances are shown herewith, and have been used with unprecedented satisfaction where articulated feet were clearly impossibilities.

The advantages derived from lightness of such artificial substitutes will readily be apparent when the resistance to motion from inertia is considered. The ankle and foot and lower part of the limb being light



LEG AND FOOT OF NATURALLY CURVED WOOD.

and hollow, move easily and promptly with but little exertion from the remaining part of the natural limb, and the comfort and ease of the wearer are thereby greatly promoted.

With the specimens of limbs are submitted well-perfected adjuncts in the way of suspender straps and girdles, and great ingenuity and skill have been displayed by these inventors in adapting limbs to specific cases which, while useful and light and highly commendable, cannot be particularized in this report.

The Franklin Institute has not made any examination in this department of the arts since January 11, 1849. Since this time about sixty or more patents have been granted for alleged improvements in artificial limbs, nearly all of which, except these, which are the subject of this report, added complications or additional parts to the limbs. In none of these inventions does there appear such desirable simplicity of construction and reduction of cost of production as in those under consideration. The makers are enabled to make most durable and substantial workmanship of all parts, and have demonstrated all of these points by making something over 9,000, which are in constant and satisfactory use.

The extreme simplicity of construction has proved the means of bringing their cost within the reach of many persons requiring such appliances, who could not otherwise afford to use and maintain them, and there are now many persons using them and actively competing with others in many lines of industry: among them machinists, blacksmiths, farmers, fishermen, carpenters, moulders, instrument makers, railway conductors, engineers, and, in fact, representatives of nearly every handicraft.

IN 1816 it took just one bushel of corn to buy one pound of nails, now one bushel of corn will buy ten pounds of nails. Then it required sixty-four bushels of barley to buy one yard of broadcloth, now the same amount of barley will pay for twenty yards of broadcloth. It then required the price of one bushel of wheat to pay for one yard of calico, now one bushel of wheat will buy twenty yards of calico.

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RECENTLY PATENTED INVENTIONS.

Engineering.

INJECTOR.—Joseph H. Killey, Hamilton, Ontario, Canada. This injector is designed for operation by low pressure or exhaust steam, and by high steam pressure in emergencies, having simple parts, easily accessible for cleaniug or repairs, and being capable of supplying very hot water to the boiler, the invention covering various novel features of construction and combinations of parts.

Railway Appliances.

CAR COUPLING. — Lewis W. Brewster and Robert Swift, Palmyra, Teun. A horizontally swinging frame with coupling hook guard is mounted on the bumper, a swinging coupling hook being located within the frame, a spring holding the coupling hook toward the guard arm, while a cam plate is pivoted to the coupling hook with a projecting arm, and a shaft is mounted on the car with a hand wheel at its upper end and a chain at its lower end connected to the arm on the cam plate, whereby the cars may be automatically coupled, and may be uncoupled without the trainmen going between them.

REPLACING FROG. — Joseph J. Ladd, Callao, Peru. This is a light, portable frog, for replaciug derailed locomotives and cars, and is designed to be entirely supported by the rails, while gravity will be made available for shifting the car or locomotive laterally.

Mechanical.

CORDAGE SPINNING MACHINE.—Anton Weber and Clement Lambert, Elizabeth, N. J. In this machine the twisting and winding mechanism is of the usual construction, but the invention covers an improvement whereby the operation of the machine is automatically stopped if the cord breaks, and the machine cannot be started until the bobbin upon which the twisted cord is wound is securely mounted upon its spindle.

MECHANICAL POWER. — Lemuel B. Walkins, Washington, La. This is a driving gear mechanism, consisting of wheels having grooved spokes with V-shaped edges, in combination with a connecting rod to which slides are pivoted, these slides working in the grooves in the spokes, the mechanism being designed for use with different machines operated by a crank.

MACHINE FOR SETTING CAR SPRINGS. —James B. Illingsworth, Monroe, La. This invention covers novel features of constrnction and combinations of parts in a machine designed to greatly facilitate the setting of locomotive springs and passenger and other car springs, and whereby the setting may be accomplished in a positive and accurate manner.

Agricultural.

HARROW ATTACHMENT FOR PLOWS. —John F. Williams, Grand Forks, Dakota Ter. This attachment consists of a toothed bar pivoted by means of a drag bar to form a flexible connection with the plow beam, whereby the harrow may be readily and effectively operated in connection with the plow, and will automatically adjust itself to any irregularity of movement of the plow.

CULTIVATORS. — Charles R. Hartman, Vincennes, Ind. Two patents in this class have been issued to this inventor, one of which embraces special improvements for readily adjusting the shovels from one pitch to another, applicable to all ground-stirring implements, as the depth of the furrow can thereby be regulated at will, regardless of the condition of the soil, or as required for the cultivation of plants in different stages of growth. One of the patents also provides a simple construction by which the cultivator teeth may be set to different adjustments, and firmly held in any suitable adjustment, the improvement being applicable to double shovel plows and similar implements as well as to cultivators, while both patents are in the line of improvements on former patented inventions in this class by the same inventor.

HAY LOADER. — Adolph Lasack, Oxford Junction, Iowa. This invention covers an improvement in hay loaders having side rakes and reciprocating elevating bars, whereby the hay may be effectually gathered from the sides as well as from the rear of the machine, and conveyed from the sides to the body, and from thence to a wagon or other vehicle.

POISON DISTRIBUTER. — Fred Eaton, Conway, N. H. The frame of the device is supported by a carrier wheel and has supporting standards with vibrating levers pivoted thereto, boxes with perforated bottoms attached to the lever arms, and a reciprocating slide, making a convenient garden implement for use in distributing poison on plants.

STRAW CUTTER.—John Topfer, Brooklyn, N. Y. Combined with a box and a knife wheel, and an endless belt in the bottom of the box, is a vertically sliding block near the cutting end of the box, a fluted roller in rear of the block and a plain roller above the fluted one, whereby straw or hay may be conveniently and expeditionsly cut to any desired length.

Miscellaneous.

WIRE STRETCHER.—Frederick Stiles, (of Harrell, Burns & Stiles), Burnet, Texas. This invention covers a stretching device for building and repairing wire fences, telegraph lines, etc., and is so arranged that with it one can pick up both ends of broken wire and draw them together, the device embracing a novel arrangement of the detent or pawl in relation to the chain and toothed wheel in the frame with crank handle.

LAMP.—Charles H. Grube, Robinson, Ill. This lamp is provided with a novel form of adjusting screw for raising and lowering the wick, one which is positive in its action and not liable to become disordered, while the oil is prevented from overflowing, and the wick may be lighted without removing the chimney.

BALING PRESS. — Leigh H. Hallam, Belton, Texas. The press consists of a plunger and plunger rod with which a reciprocating sliding frame is connected, a rotary shaft on which a draught sweep is mounted having an arm actuating the sliding frame, by which a direct stroke is given to the plunger, and the latter permitted to rebound by the recoil of the hay, while the hay is properly held in position.

INK ERASER. — Charles W. Johnston, Louisville, Ky. This eraser consists of a thick plate or block-like piece of steel, having a rounded and convex erasing surface, with a file-cut dress, one of the sides or edges also having a further double convex surface of smooth finish, to be used in glazing or smoothing the paper afterward.

CONVEYER. — Charles N. Newcomb, Omaha, Neb. This invention covers a novel construction and combination of parts in conveyers adapted to carry parcels or loads from one point to another upon the same level, and provides for the transportation by gravity of a load suspended from a cable, from end to end of the cable, the empty carrier or another load being returned.

PAPER HOLDER FOR TYPE WRITERS. —William B. Northrop, Charleston, S. C. This is an attachment to be adjusted to any machine to permit the nse of any width and length of paper, holding the print clearly in view, and providing for automatically feeding the written paper away from the impression roller, the device being simple and inexpensive.

ENVELOPE. — John O. Donnell, Lowville, N. Y. This invention covers a triple-sealed safety envelope, which cannot be opened as can the ordinary envelope by a pencil or other instrument, and which is designed to protect letters, or the envelopes containing them, from being surreptitiously opened and resealed.

SCIENTIFIC AMERICAN
BUILDING EDITION.

JUNE NUMBER.—(No. 44.)

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2. Plate in colors of a cottage costing three thousand two hundred dollars. Perspective elevation, floor plans and details.
3. Engraving of the new Federal building to be erected at Worcester, Mass. Cost two hundred and fifty thousand dollars.
4. A cottage of moderate cost lately erected at Bedford Park, New York. Perspective and floor plans.
5. Plans and perspective of a convenient stable erected at Bedford Park, N. Y.
6. A handsome residence lately erected at Chattanooga, Tenn., from designs by Blotberwick & Penn, architects. Cost ten thousand dollars complete. Plans and perspective elevation.
7. A residence at Florence, Northampton, Mass. Cost ten thousand dollars complete. Perspective and floor plans.
8. Engraving of a half-timbered house at Chester, England.
9. View and plans of a fine barn lately erected near Providence, R. I.
10. A modern residence at Belle Haven Park, Greenwich, Conn. Perspective and floor plans.
11. A handsome house in the colonial style lately erected at "Reholds Terrace," Orange, N. J., at a cost of fifteen thousand dollars complete. Chas. A. Gifford, of London, architect. Perspective elevation and floor plans.
12. A cottage at Bedford Park, New York. Cost eight thousand five hundred dollars. Plans and perspective.
13. Engravings of the great Eiffel tower at the French exhibition.
14. St. Cloud Prebyterian Church, Orange, N. J. Potter & Robertson, architects, New York. Perspective elevation and floor plan. Cost seven thousand five hundred dollars.
15. Miscellaneous Contents: Brick piers. — Home decorations.—Delights of color.—Foundations in alluvial deposits.—Portland cement and sea water. —The effect of moisture on wood.—The weeping larch, illustrated.—Nashville's estimating rules.—Selected lumber.—The science of dry rot.—Sewage a protection against the teredo.—Ornamental borders, with illustrations.—Hot air *vs.* steam.—The new Catholic cathedral at Pekin.—Advantage of sanitary measures.—Which are the hardwoods? —An ideal living room.—A water motor for elevators, illustrated.—Granite rust. — Ventilating grates, illustrated. — French building laws. — Mahogany.—Artistic wood work, with illustrations.—Stains for mortar and plaster.—An enduring tin roof.—Wood filling and finishing.—Shell fish marbles.—Fire-resisting ceilings.

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Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

Billings' Patent Adjustable Tap and Reamer Wrenches. Bronze Forgings. Billings & Spencer Co., Hartford, Conn.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Investigate Edson's Recording Steam Gauges. Save coal, etc. Write for pamphlet. J. B. Edson, 86 Liberty St., N.Y.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. The D. Frisbie Co., 112 Liberty St., N. Y.

Veneer machines, with latest improvements. Farrel Fdry. and Mach. Co., Ansonia, Conn. Send for circular.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p.28.

Rotary veneer basket and fruit package machinery. I. E. Merritt Co., Lockport, N. Y.

Pedestal tenoner. All kinds woodworking machinery. C. B. Rogers & Co., Norwich, Conn.

Woodworking machinery, planers, surfacers, matchers, beaders, etc. Rollstone Machine Co., Fitchburg, Mass.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(913) W. B. P. asks: Can you tell me how paint can be made to dry, made of Venetian red, naphtha, and Smith's Ferry (mineral) oil? What will give a gloss? What proportions should I use for dipping paint? A. Your only relief is to mix a quantity of linseed oil with the paint, and you will probably have to abandon entirely the use of petroleum. The proportions for different uses you must determine by experiment. Everything depends on the quality of the pigment and whether it is ground with the oil or not.

(914) S. K. K., of Bombay, writes: 1. I have successfully constructed the dynamo described in SUPPLEMENT, No. 600, and the motor described in SUPPLEMENT, No. 641, and I now desire to make a dynamo for the electro deposition of copper. How shall I proceed to construct a machine that will yield a large current with a low electromotive force? A. An electroplating machine of the size of the eight-light dynamo may be made by modifying that dynamo in the following way: Make the commutator cylinder and the brushes of double the present width. Increase the diameter of the commutator cylinder 1/4 inch, and use only half the number of commutator bars. Wind on the armature the same quantity of the same size wire, but instead of carrying it several times around the armature core, arrange the eight wires in parallel so as to form in each coil of the armature a multiple conductor of very low resistance, beginning at one commutator bar and terminating at the next. Wound in this way the armature will have in each division one coil of one convolution and only half the number of coils used in the 8 light machine. The field magnet may remain as it is, but it must be connected as a shunt to the armature, and a switch must be provided which will throw all the wire in series, or two in parallel or four in parallel, or the wire of both legs of the maguet in parallel, according to the current required. In view of the large number of wires to be connected with each bar of the commutator, it would be well to provide the bars with radial arms for receiving the conductors. There would be an advantage in winding the armature with a smaller number of coarser wires, say half the number of No. 17, or quarter the number of No. 14, the conductivity beiug the same in each case. 2. Can I charge storage batterries with such a dynamo? If so, how? A. Yes; by connecting them up in parallel. For information on storage batteries we refer you to Reynier's "Voltaic Accumulator," price $3. 3. What is the *modus operandi* of refining sugar by electricity? A. We believe the electric sugar refining process has proved a failure. The details of the process have not been made public.

(915) C. E. L. writes: 1. In your No. of April 27 you give, "bicarbonate of ammonia and sulphate of soda in strong solution" as the best solution for hand grenades to extinguish fire. How long will this compound keep without losing its properties as an extinguisher? A. Indefinitely, if the bottle is well corked. 2. To how high a temperature could water be raised in flat sheet iron or cast iron vessels before doing damage, if strongly braced? What number of pounds pressure would the temperature indicate? Of course I desire the results in iron of different thicknesses. A. It depends on the bracing; no general answer can possibly be given. The iron begins to soften as it approaches red heat at about 750° Fah. 3. What are the elements in sorghum molasses that boiling removes before the sirup loses its greenish color and becomes clear? And what, if any, chemicals will remove the same? A. It contains nitrogenous impurities and salts of organic acids of which little is known. Lime is used in its defecation.

(916) E. C. A. says: Will you please inform us grape growers of Oswego County, N. Y., through your paper, what to put on our vines to rid us of the pest (bug) which we inclose? A. The specimens were the common grapevine flea beetle, *Haltica chalybea*. The principal damage done by this insect is in the early spring, when it issues from its hibernating quarters and gnaws the buds of the grapevine. Taken at this time it can be destroyed by the spraying of the vines in the heat of the day with a dilute kerosene emulsion or with one of the arsenical solutions, which however should not be used in stronger proportion than 1 ounce to 10 or 15 gallons of water. They are also readily jarred from the vines and can be caught upon cloths saturated with kerosene. This last method was practiced with great success some years ago in a large vineyard near Washington.

(917) D. C.—High pressure engines are those that run by steam direct from the boiler and exhaust into the air. Low pressure engines are those that run with a vacuum on the preceding side of the piston, and are "condensing" in the manner of forming the vacuum by injecting cold water into a receiver of the exhaust steam. Eccentrics are the cam pieces on the shaft for moving the valve. See a good work on the steam engine, such as the American Steam Engineer, by Edwards, which we can mail for $2.50.

(918) W. P. P.—For the information you desire regarding electric motors we refer you to "Dynamo Electric Machines," by Hering, price $2.50, or Thompson's "Dynamo Electric Machinery," price $5. For full information on storage batteres we refer you to Reynier's "Voltaic Accumulators," price $3.00. We can mail you the above named books on receipt of price.

(919) H. S. asks for a recipe for coloring wool cloth black, jet black, and the process. A. Perhaps the easiest way is to use aniline black or nigrosine dissolved in water into which the goods are dipped. Or a bath of logwood extract may be employed, followed by a bath of copperas. The latter black is best over some ground, such as indigo. The cloth in the latter case should be well washed after drying. Or try following: Work for one hour in a bath containing 8 ounces bichromate potash, 6 ounces alum, 4 ounces fustic to the gallon; lift and expose to the air for a short time, wash well, and work for an hour in a bath of 4 pounds logwood, 4 ounces barwood, and 4 ounces fustic to the gallon; lift and add to bath 4 ounces copperas in solution; work half an hour in this.

(920) H. R. asks for some preparation that will clean the green mould off brownstone. A. Scrub it with sand and water; we know of no other effectual way. To insure prompt attention, your letter should have been signed in full.

(921) "Scientist" asks for the best way to liquefy the T. & M. blacking. I have used vinegar, but it dries too quickly on leather. A. To prevent too rapid drying use a little molasses, sugar and water, or glycerine. Determine the exact amount by trial and be careful not to use too much.

(922) A. F. asks if there is any process for preserving fruit in its natural state. A. On a small scale some attempt may be made by tightly wrapping the fruit in tinfoil. Otherwise it must be canned or preserved in sirup or alcohol.

(923) B. L. asks: Will you kindly tell me how to mix the ingredients for cologne, the recipes of which were given in one of your recent issues? Also how much alcohol is used in making heliotrope? A. Mix in a large bottle so as to shake well, and if necessary distill. Use strongest alcohol. For 25 quarts of alcohol 85° use 19 to 40 ounces extract of heliotrope.

(924) E. S. F. asks for a receipt for making kumys or koumiss. A. Mix 100 parts condensed milk with 1,000 of water, add 1 part lactic acid, 1/8 part

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citric acid, and 15 parts best Jamaica rum. Saturate with carbonic acid gas, fill in bottles, and keep for a few days in a moderately warm room; after this keep in a cool place.

(925) R. L. D.—The water line in the mercury flask boiler described in SUPPLEMENT 182 should be at a point about half way up the upper tier of flasks.

(926) A. S. asks how to make a rain box such as is used on the stage to represent rain. Also how to make and what powder to use in a flash box. Also how to represent the blowing of wind on the stage. A. For description of stage machinery we refer you to our SUPPLEMENT, No. 268, and to the SCIENTIFIC AMERICAN of December 22, 1888. Powdered resin, lycopodium, or magnesium powdered may be used in flash boxes.

(927) M. H. S. asks for a material which can be applied to or incorporated with paper which will render it waterproof. A waterproofing which is effectual and cheap is desired. A. Use spirit varnish, linseed oil, or melted paraffin.

(928) C. R. asks: Would it be practical to make the dimensions of the motor described in SUPPLEMENT, No. 641, about half size? Also would it be practical to use annealed cast iron for the cores and pole pieces of the electro-magnets instead of those bands of wrought iron? About how many batteries would it take of an E. M. F. of about two volts, strength of current about 5·5 amperes, to run a sewing machine or small electro-plater's lathe? A. The motor referred to cannot be made smaller to advantage. Cast iron will answer for the field magnet. It will require eight cells of the battery you describe to drive the motor.

(929) A. B. F. writes: 1. In close plating silver on carriage work, I have noticed that they use a file to scratch the iron in order to make the solder stick, which is a slow process. Why not use a belt machine or wheel with coarse emery? A. A rotary file might answer, but we think an emery belt would be objectionable on account of the particles of emery that might become embedded in the iron. 2. I have a large number of electric arc lamps under my care, and I find a great many of the rods crack in cold weather. Why is this? These rods are hollow. Would it help if the hollow rods had a vent hole to allow the hot air to escape when lamp stopped burning? A. The fault in the carbons is in the manufacture. They are probably too dense. 3. In stores where electric light wires run along the ceiling much dust collects on ceiling around the wires. What will remove this from ceiling? A. We know of nothing better than a stiff brush. The accumulation of dust cannot be prevented when the wires are very near or in contact with the ceiling.

(930) C. T. H. asks: 1. How much current in amperes No. 30 copper wire, American gauge, will stand witnout heating? A. 0·09 ampere. 2. What is the rule for finding capacity in amperes of any given size wire? A. Multiply the sectional area of the wire in inches by 1,900. The result will be the number of amperes the wire will safely carry.

(931) C. P. W. asks: What is the gum lac spoken of in the article about batteries in the SUPPLEMENT, No. 159? Also what kind of carbon, whether graphite or coke, and whether powdered or granulated, and in what proportion to use to make the depolarizer for an improved Leclanche battery, also whether the manganese dioxide should be powdered, or the natural crystals or ore. Also what is the gold beater's skin that is used for the diaphragm to the phonograph? A. The gum lac referred to is simply shellac. If drug stores do not keep it, inquire at the paint stores. The carbon is pulverized coke. The proportions are as follows:

Manganese	40 parts.
Carbon	52 "
Shellac	5 "
Potassium bisulphide	2 "

Mix dry and compress under a pressure of 800 to 1,000 lb. per square inch at a temperature of 212° F. Gold beater's skin is a thin membrane taken from the intestines of the ox. Probably a thin piece of fish's bladder will answer your purpose.

(932) L. W.—In your simple electric motor, have you tested the polarity of the field magnet above and below the armature? Of course the upper and lower parts should have different polarity. If your field magnet is a made of sheet iron, we doubt if you will be able to generate a current without separately exciting the field.

(933) F. E. H. asks: Does a bichromate of potash battery need to be covered? A. The only advantage in a cover is to prevent evaporation.

(934) F. L. M.—You can work your relay and sounder on the line, but you will need a large battery, and the arrangement will prove uneconomical. Better dispose of your 150 ohm relay and replace it with one of the same resistance as the sounder.

(935) T. M. asks: 1. Would sheet zinc, if amalgamated, do in place of the cast zincs in the Bunsen battery? A. Yes; provided it is thick enough. It should not be less than 1/8 inch thick, and it might be 1/4 inch thick to advantage. 2. Should the side of porous cell be very thick? A. They should be of medium thickness. If too thin, they cause the battery to run down quickly. If too thick, the resistance of the battery will be unduly increased. 3. Can the carbon rods used in electric lights be used in the battery? A. Yes; after removing the copper coating with nitric acid.

(936) N. G. P. asks: What are the three best non-conductors of heat? A. It is hard to answer this question without qualification. For high degrees of heat zirconia is about the best non-conductor known, while lime and porous clay come close to it. Among building materials, plaster and sand mixed come very low, having less than one-fifth the conducting power of slate. Water is an exceedingly bad conductor, and it is by conversion that heat is generally distributed through its mass.

(937) D. J. B. asks: 1. How to cut the round hollow glass for a lubricator? A. To cut glass tubing for lubricators and water gauges, break the end off from a round file of suitable size, so as to have a sharp edge to the point. Insert the file inside of the glass tube and carefully scratch around the inner surface at the proper distance. A crack will follow the file, when the tube can be easily broken at the file mark. Try it on an old tube, as a little practice may be required. 2. How to find the dead center of a steam engine, in order to set the slide valve. A. For all practical purposes for setting the valve, the dead center may be obtained by marking the extreme positions of the gibs on the slide, moving the flywheel both ways across the dead center to check the mark, when the mean difference can be marked on the flywheel by a fixed pointer, and the difference divided, when the flywheel can be moved, so that the differential mark will coincide with the pointer. 3. What kind of oil would you recommend the best for high speed engine? A. You require the best "cylinder oil" for high speed engines. It is known in the oil trade.

(938) G. B.—Cast iron for nickel plating should be finished fine with a soft emery buff, made by covering a wheel with leather and applying fine emery, about No. 100 to 120, with glue. Goods that are not flat are sometimes finished in a tumbling machine to the desired finish for nickeling.

(939) E.—Iron sliding poles in engine houses would have less friction than brass, if kept bright and smooth. The brass poles do not rust and are easily kept bright. Their appearance also probably recommends the brass poles to firemen. The iron poles, besides, will rust so much as to stain the hands in one wet day.

(940) G. H. R.—Acoustic telephones requiring no batteries are now used to some extent in the U. S., and are much cheaper than the price you name. They are in use for distances over a thousand feet. These telephones are made of thin metallic disks or combinations of metal and hard rubber disks 3 to 4 inches in diameter, attached at their centers to a wire of hard copper or steel stretched between the points of communication. The disks are held in frames fastened to the building. In long distances the wires may be suspended in rubber slings to poles. In fact, it is the common toy telephone on a large scale. For the horse power of a water way, approximately, measure the area or section of a stream (its mean depth multiplied by the width in feet) at a convenient place for measurement of the velocity in feet per minute by the floating of an object in the water. Multiply the area by the velocity, which will give the number of cubic feet passing per minute. Multiply this product by 62½ (pounds per cubic foot), and the last product by the height in feet which can be obtained or utilized upon a wheel or turbine. Divide the whole product by 33,000 for the horse power. Of this power you may utilize about 75 per cent.

(941) W. S. asks: 1. Would glass cells answer for plunge battery (such as you described in the SCIENTIFIC AMERICAN) as well as mill board? A. Except for liability to breakage, glass is the best material for plunging battery cells. 2. What will be the best liquid solution to use in the battery? A. Into a cold saturated solution of bichromate of potash in water slowly pour sulphuric acid, one-fifth of the volume of the solution by measure. This mixture shoud be made in a glazed earthen vessel. 3. Would sheet iron in 4 or 6 foot lengths, joined with rivets to make the full length, not do better than butting them? A. There is no advantage in riveting the pieces of iron together. 4. Would not light hoop iron do as well as sheet iron? A. Yes. 5. What is it that becomes exhausted in the battery; is it the zinc or the carbons or both? A. The zinc and the solution. The carbon plates are not affected. 6. Will it be necessary to renew the solution when the zinc or carbons become exhausted? A. The solution requires frequent renewal. The zincs will last some time if properly amalgamated.

(942) W. M. S. asks: 1. How much of the energy is lost in charging and discharging a storage battery? A. About 10 per cent. 2. How must I adjust the brushes of simple electric motor which has a commutator like a large one? A. Arrange the commutator brushes so that they will touch the commutator at points opposite the center of the spaces between the arms of the field magnet. 3. What is the best book which tells all about electricity, motors, dynamos, storage batteries, etc.? A. Probably the best single book for your purpose is "Electricity in the Service of Man," by Urbinsky. 4. How many volts does it take to kill a person instantly? A. It requires an electromotive force of from 600 volts upward. 5. Does a so-called "interrupter" make it easier for a current to pass through the body? A. The interrupter does not facilitate the passage of the current through the body, but it intensifies the effect of the current upon the nerves.

(943) F. W. S. writes: 1. How shall I proceed to extract the perfume from the petals of roses or other flowers by the use of grease? A. Melt a mixture of purified lard and purified tallow over a water bath and immerse an equal weight of rose petals in it. After they have been stirred well together, keep covered for 24 hours, stirring occasionally the cool mass. Remelt and keep in fusion another day, with frequent stirring. Strain through a coarse cloth and repeat a number of times; twelve repetitions with fresh petals is prescribed. After all is done, allow the melted pomade to settle, and pour off into pots. 2. What is black soap? A. Black soap is the name given to the crude soap separated by remelting from the first saponification. It is also applied to a farrier's soap made from fish oils and potash. 3. Give a formula for a good white rose extract without the use of pomades? A. Distill 5 quarts of rectified spirits from 3 lb. of rose petals; repeat with the same distillate but with a fresh portion of etals a number of times until sufficiently strong. At the end of the operation only distill one gallon, and do it rapidly. Or simply add a little attar of roses to alcohol until perfumed to suit the taste. 4. How is coumarin prepared? A. Tonka beans are cut up finely, and are heated for a long time with alcohol (0·863 spec. gr.) nearly to boiling. The tincture is poured off and the process is repeated. The tinctures are mixed and the alcohol is distilled off until the residual liquid is turbid, when four times the bulk of water is added. It is heated to boiling, filtered, and coumarin separates on cooling. One pound of beans gave 108 grains of coumarin.

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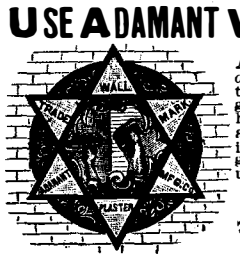

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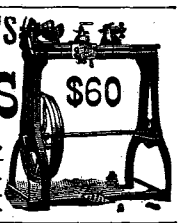

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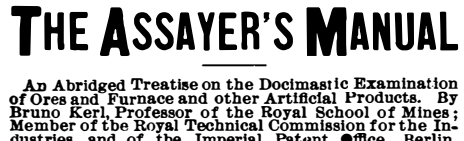

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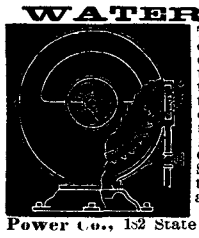

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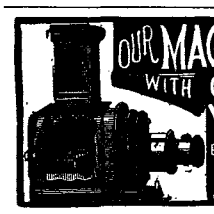

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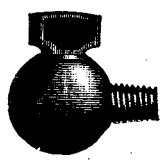

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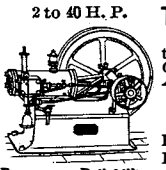

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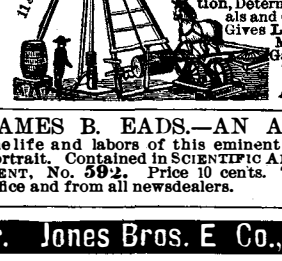

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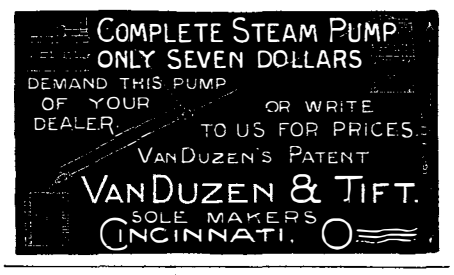

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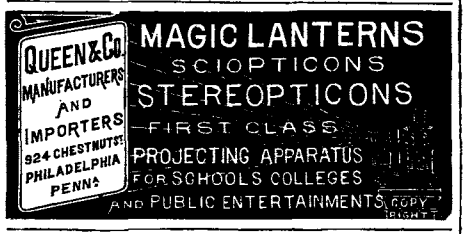

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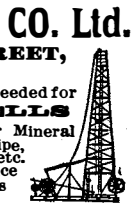

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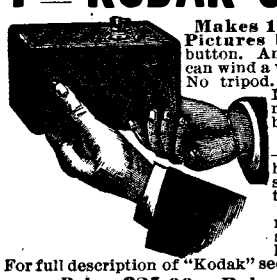

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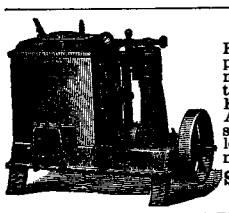

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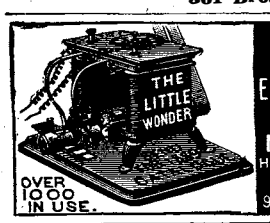

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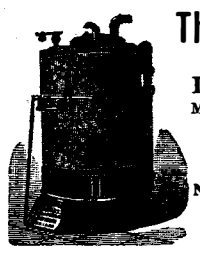

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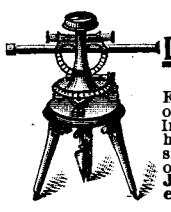

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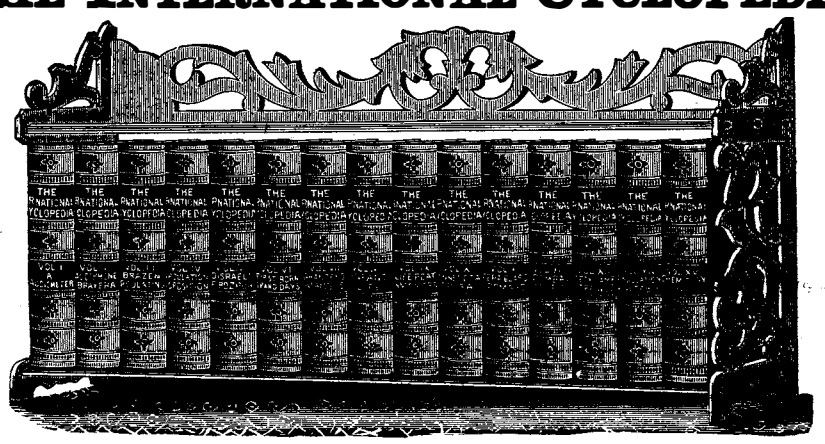

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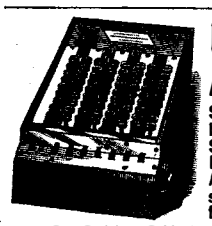

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